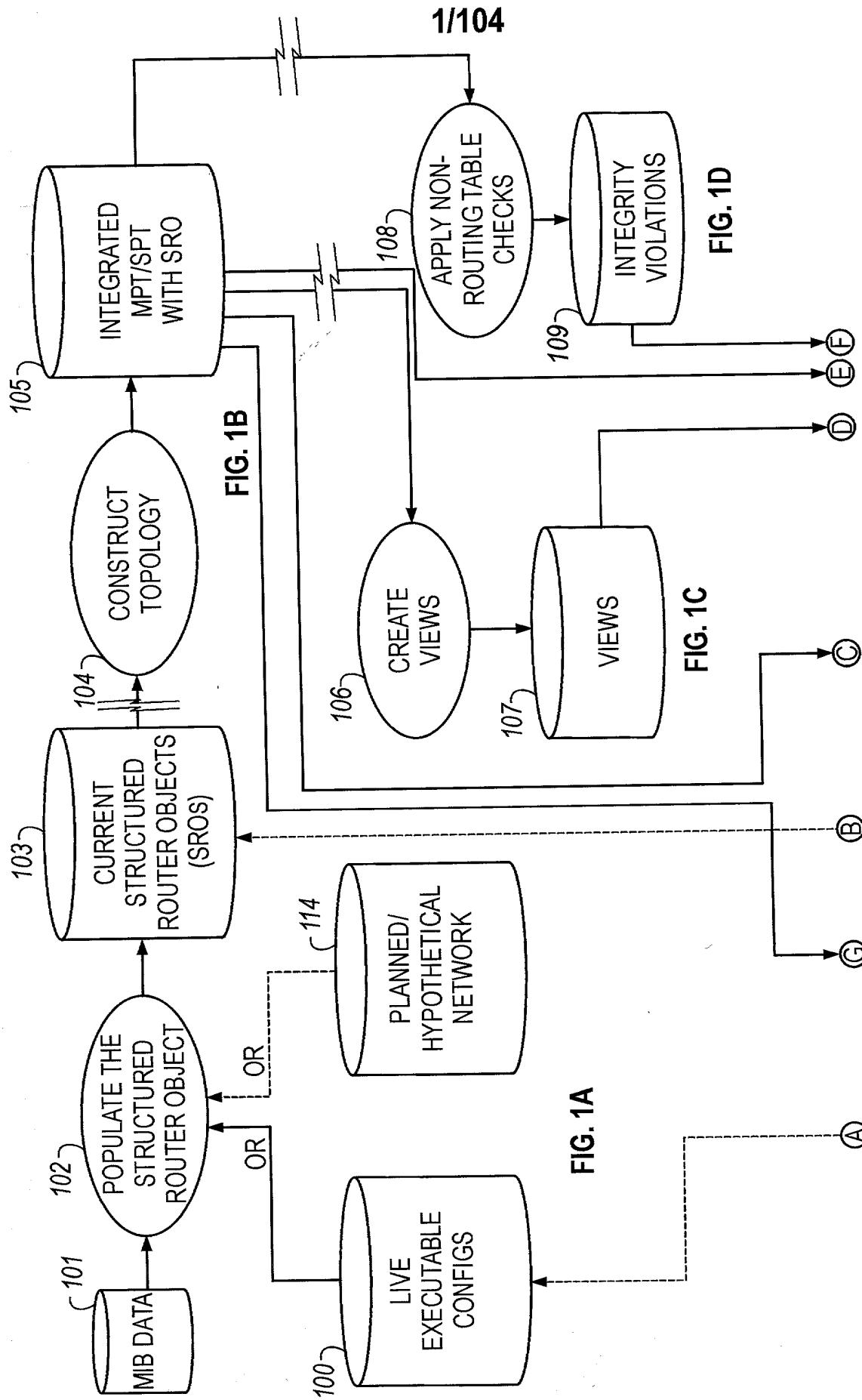
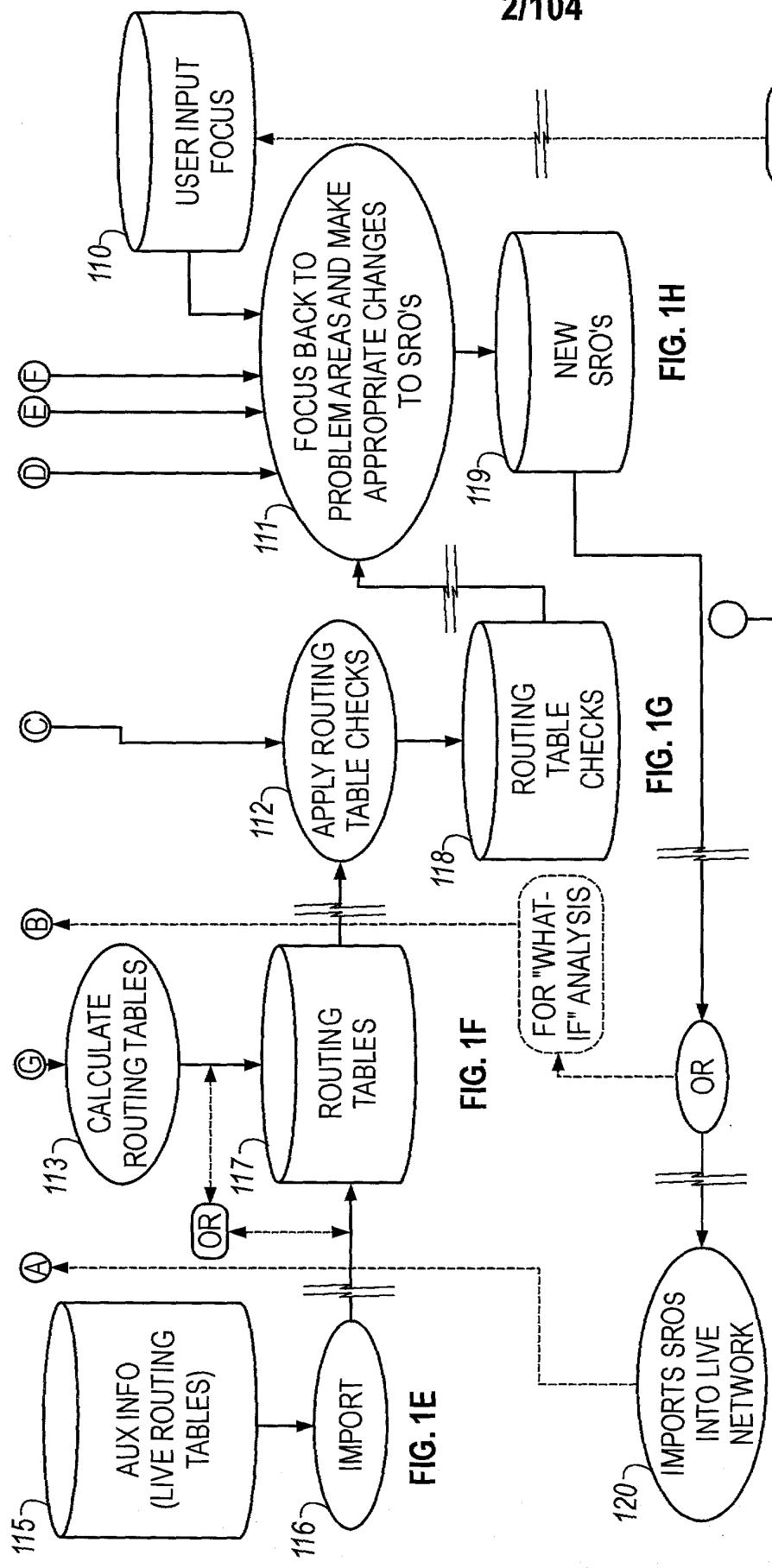


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**FIG. 1H**

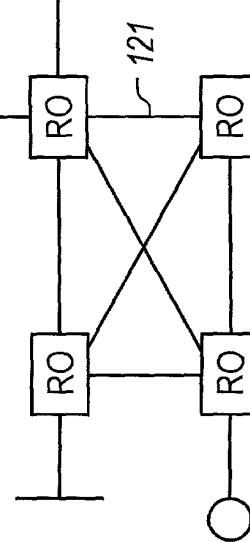


FIG. 3

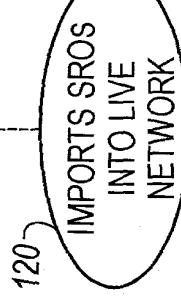


FIG. 11

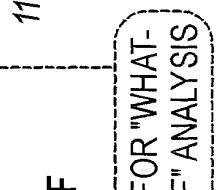


FIG. 1F

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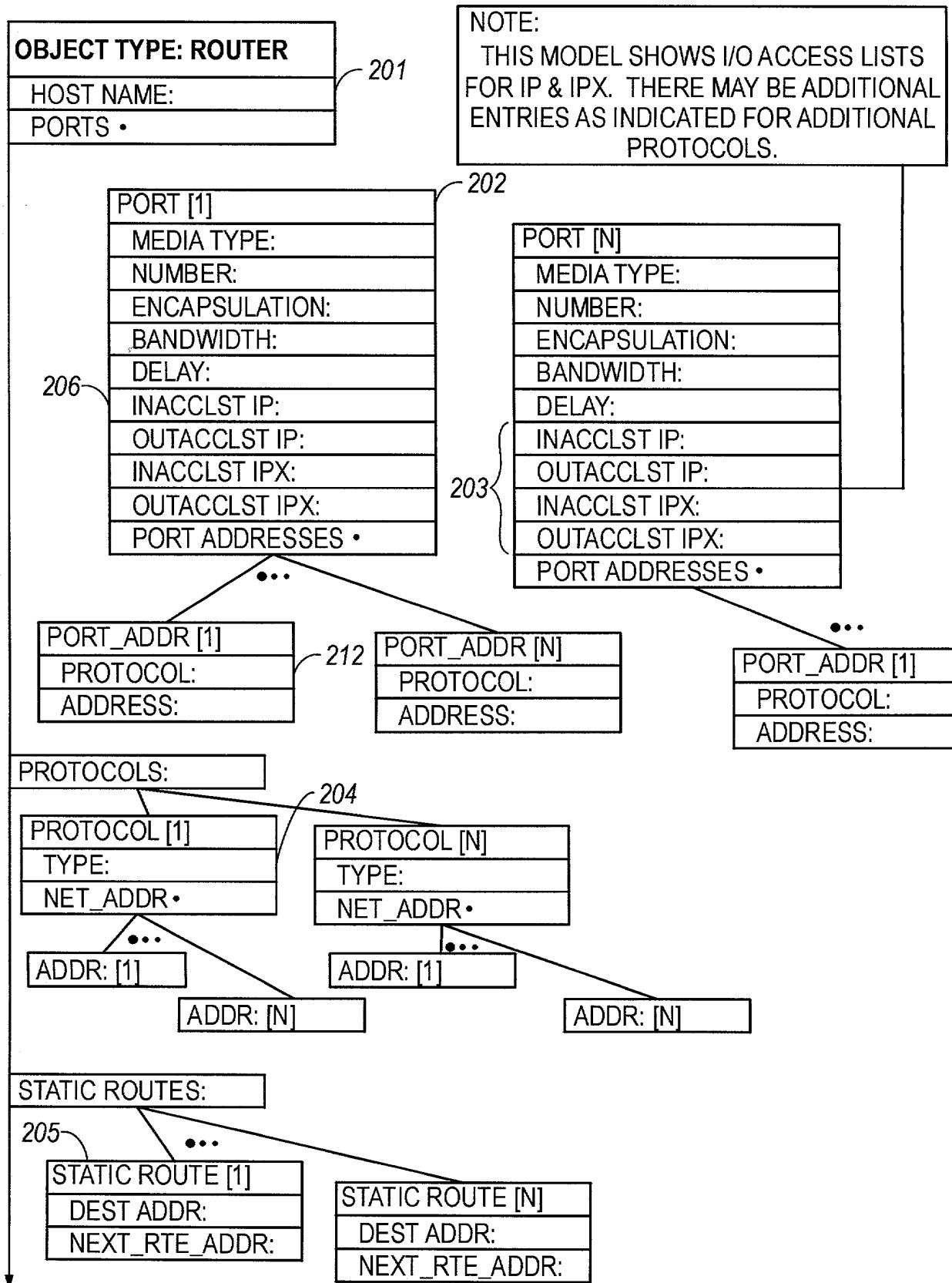


FIG. 2A

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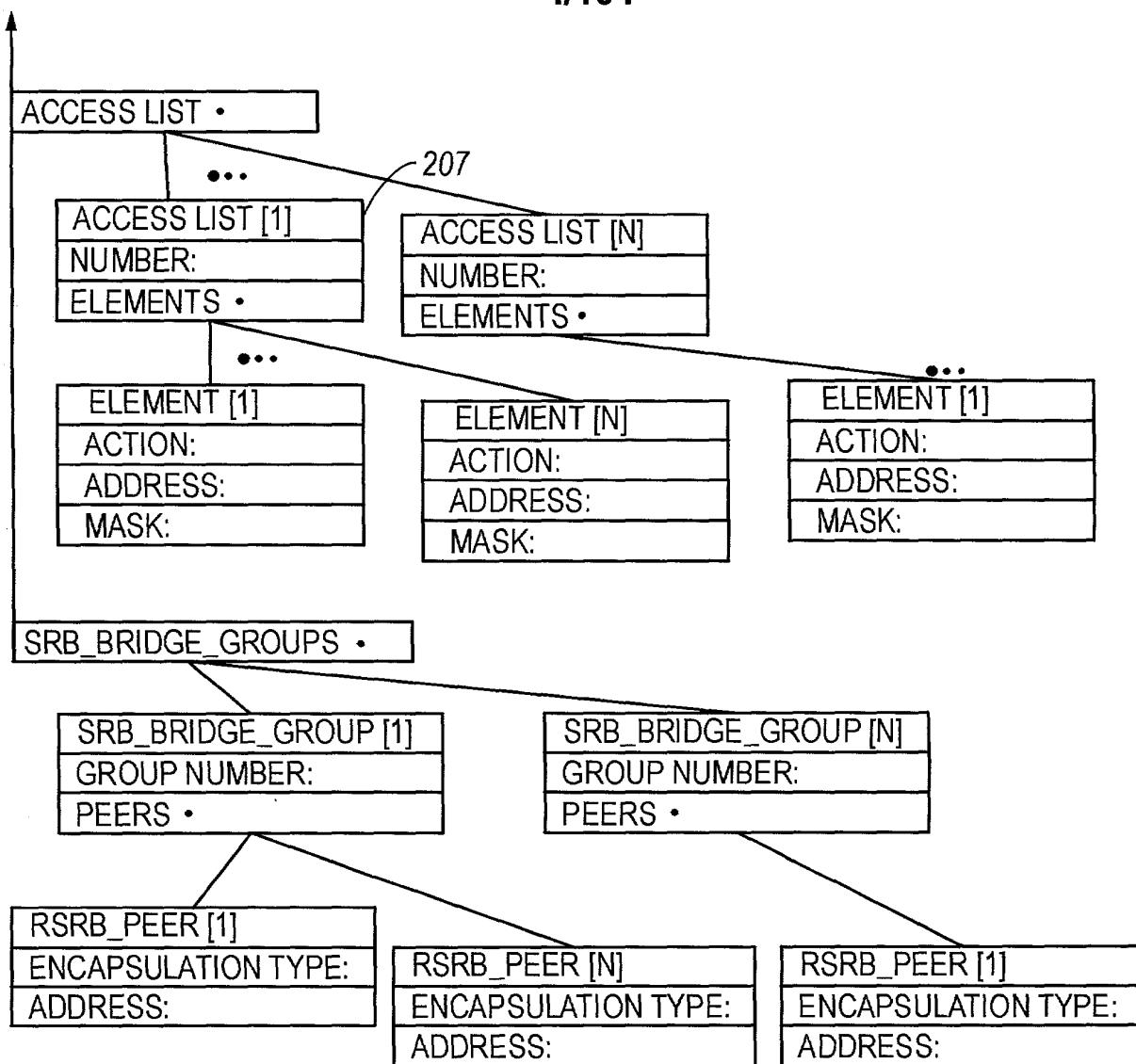


FIG. 2B

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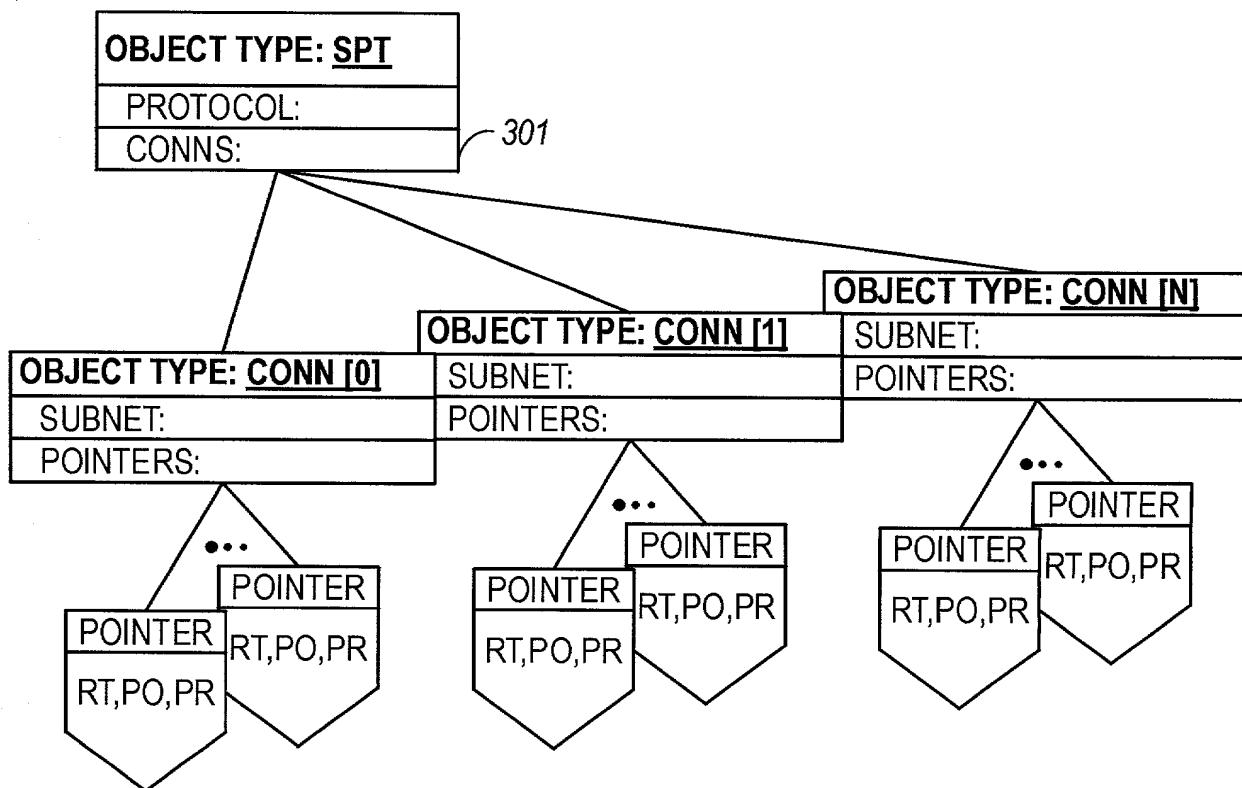
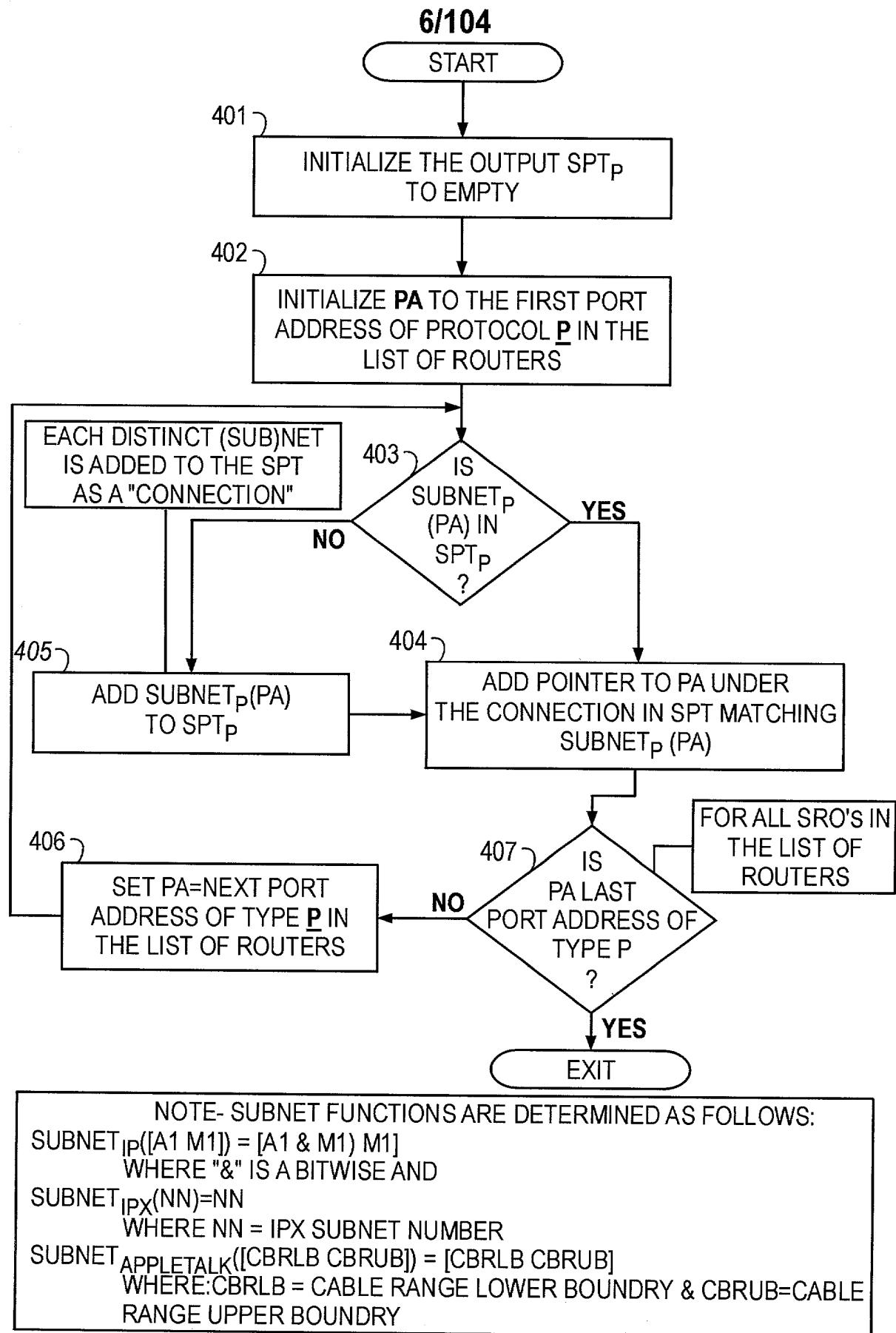


FIG. 3

NOTE:  
RT=ROUTER  
PO=PORT  
PR=PROTOCOL



**FIG. 4**

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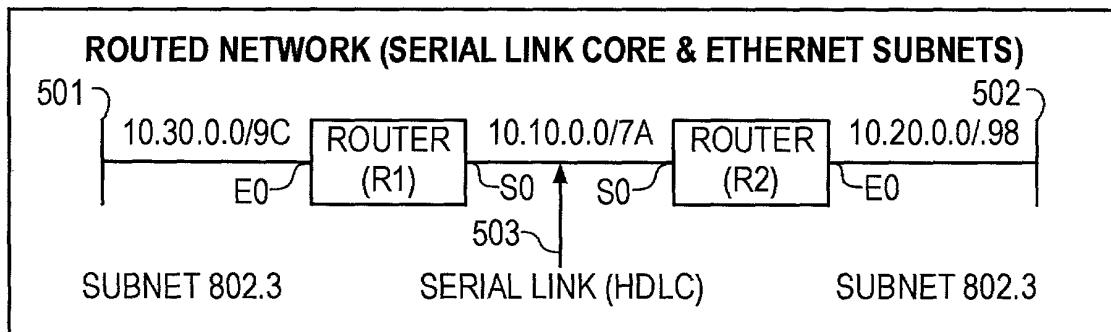


FIG. 5

**ROUTER R1:**

```
VERSION 10.0
!
HOSTNAME R1
!
NOVELL ROUTING 0000.0C08.94DD
!
INTERFACE ETHERNET0
IP ADDRESS 10.30.7.2 255.255.0.0
IPX NETWORK 9C
!
INTERFACE SERIAL0
IP ADDRESS 10.10.4.1 255.255.0.0
IPX NETWORK 7A
BANDWIDTH 1000
!
ROUTER IGRP 109
NETWORK 10.0.0.0
!
```

**ROUTER R2:**

```
VERSION 10.0
!
HOSTNAME R2
!
NOVELL ROUTING 0000.0C04.3A3E
!
INTERFACE ETHERNET0
IP ADDRESS 10.20.5.2 255.255.0.0
IPX NETWORK 98
!
INTERFACE SERIAL0
IP ADDRESS 10.10.4.2 255.255.0.0
IPX NETWORK 7A
!
ROUTER IGRP 109
NETWORK 10.0.0.0
!
STATIC ROUTE DEFINITION
IP 70.70.3.0 255.255.0.0 199.37.28.3
```

FIG. 6A

FIG. 6B

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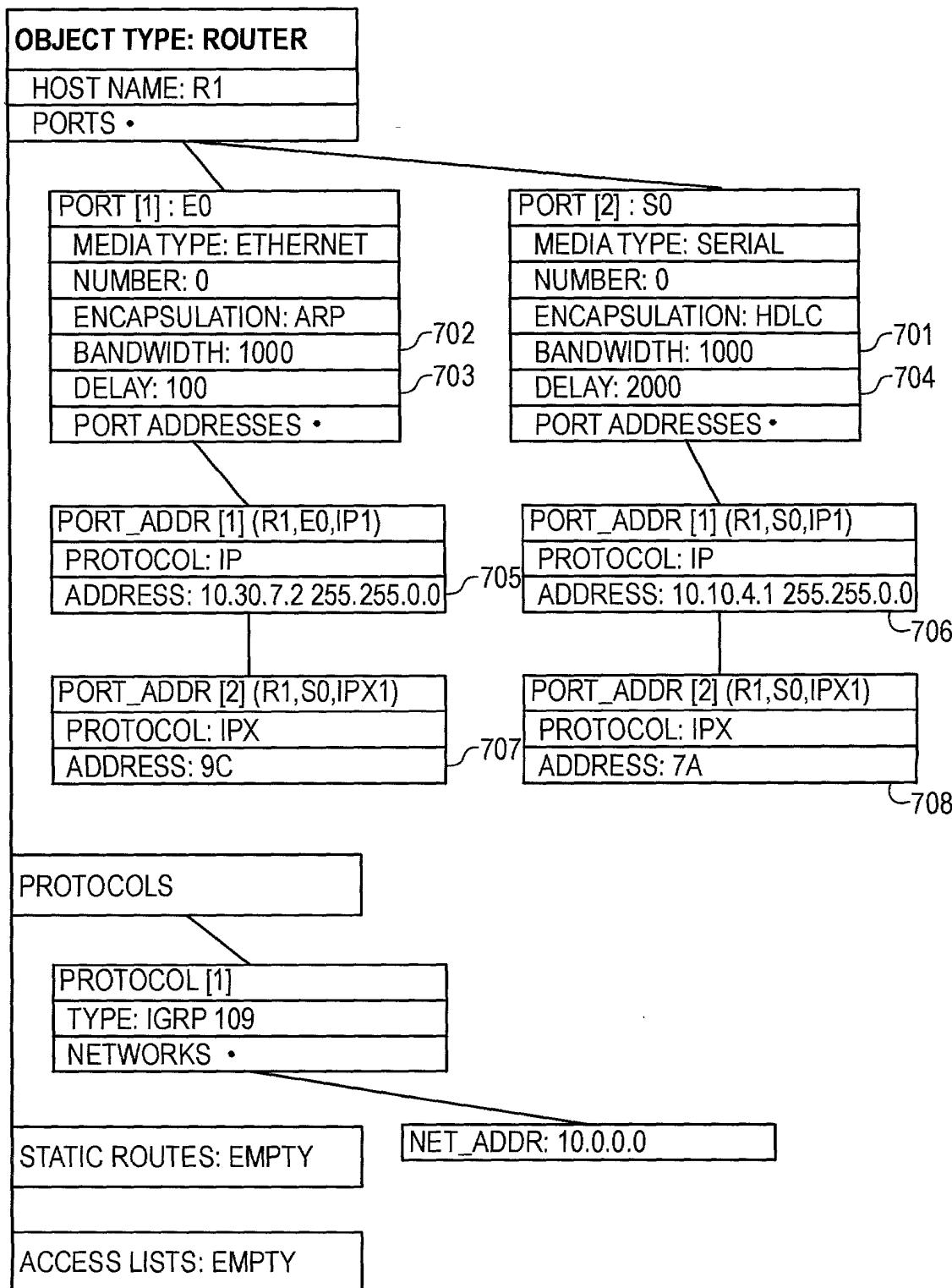


FIG. 7A

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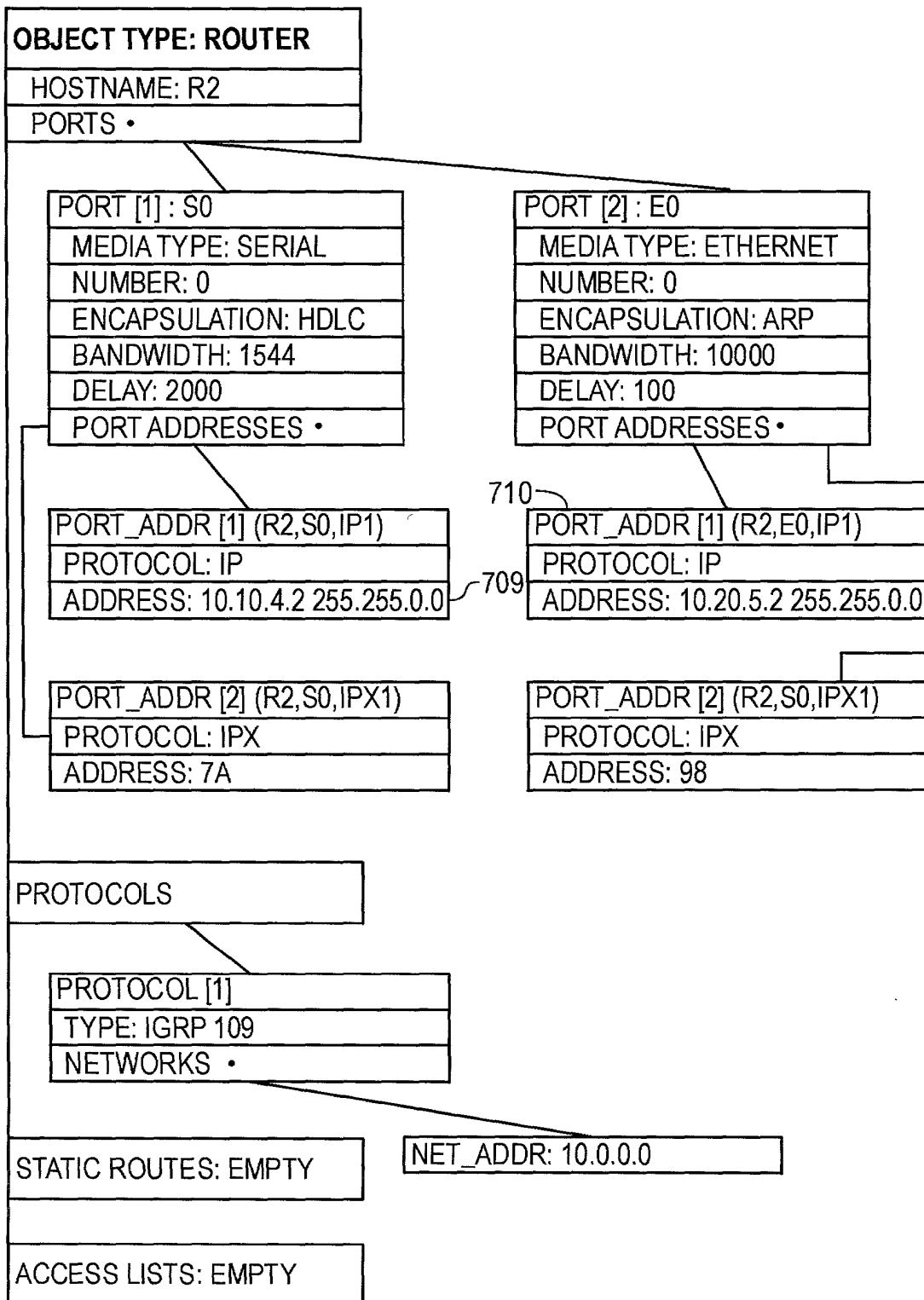


FIG. 7B

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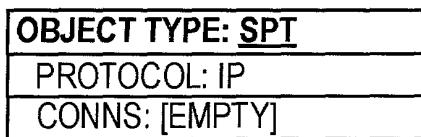


FIG. 8A

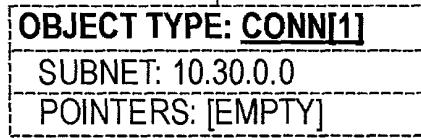
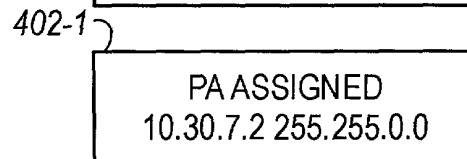
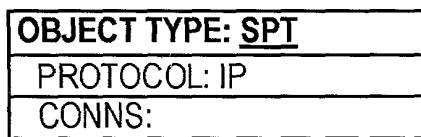
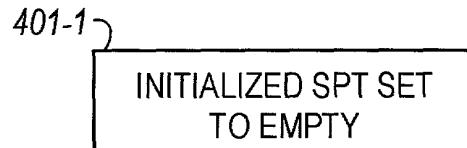


FIG. 8B

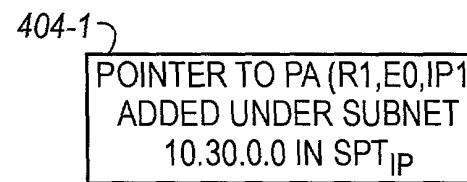
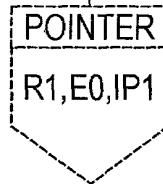
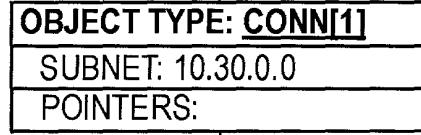
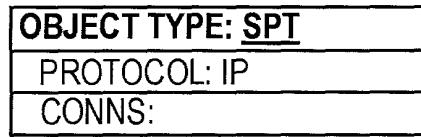
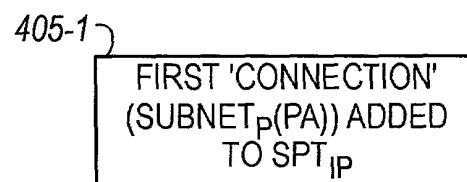
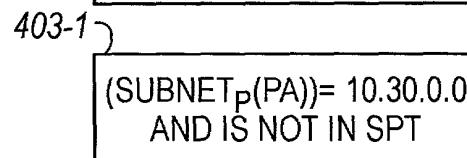


FIG. 8C

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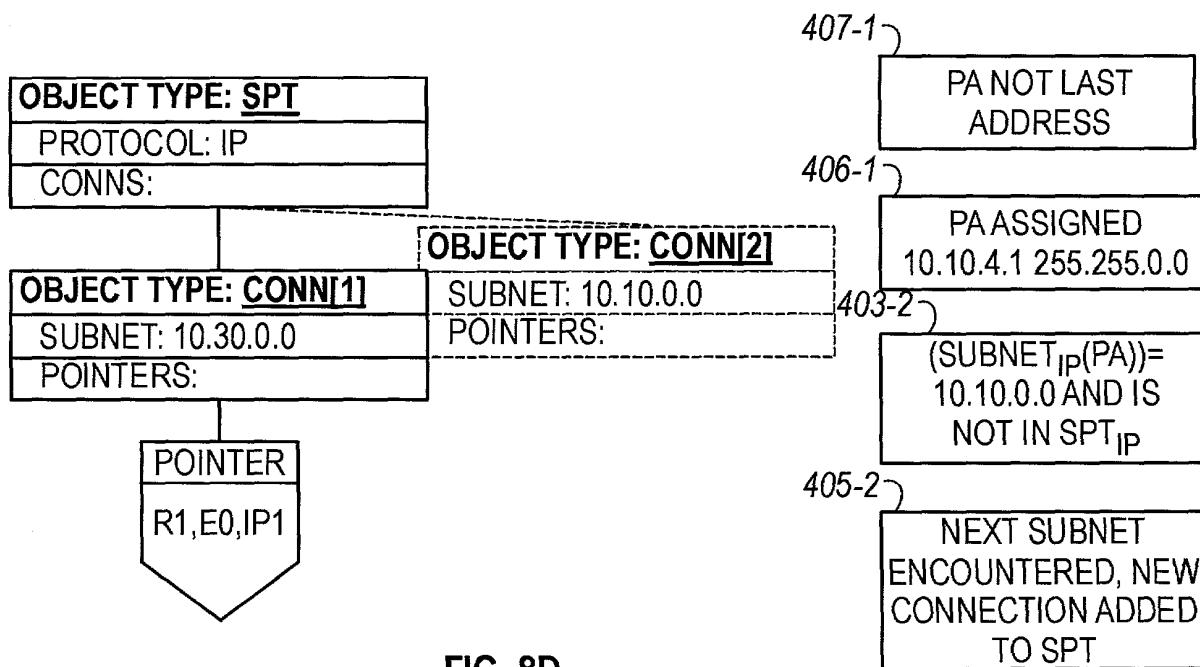


FIG. 8D

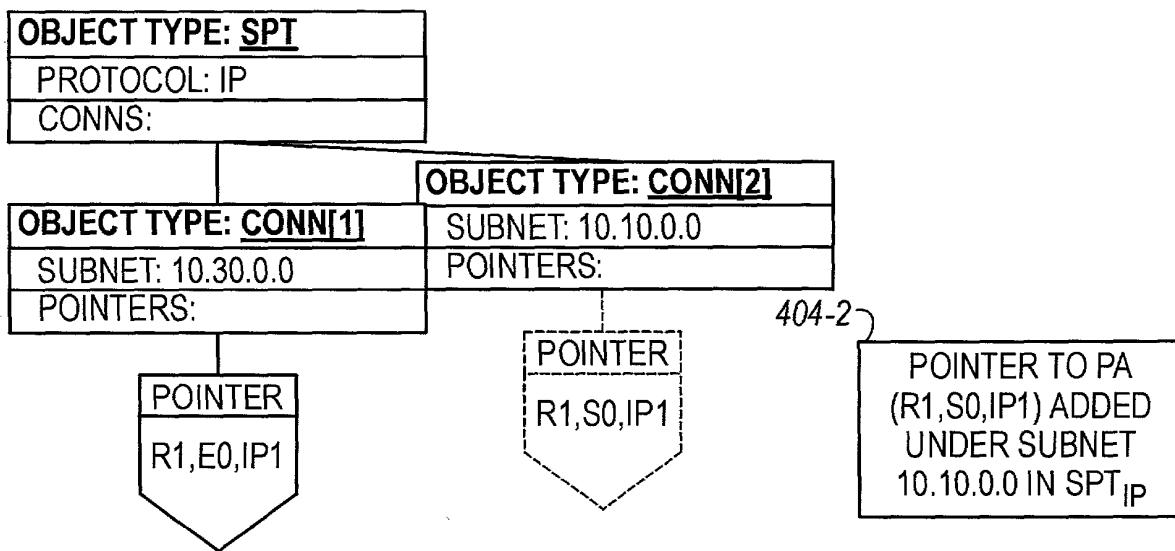


FIG. 8E

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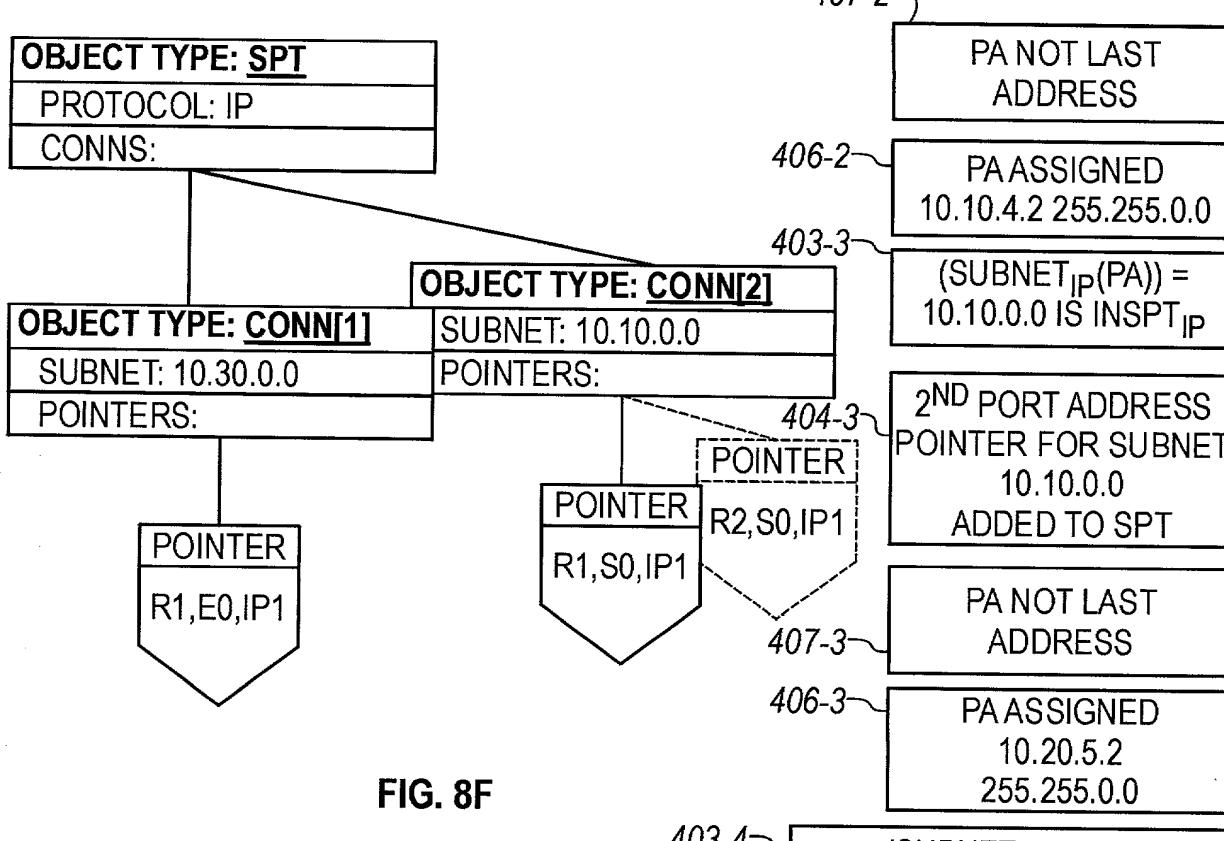


FIG. 8F

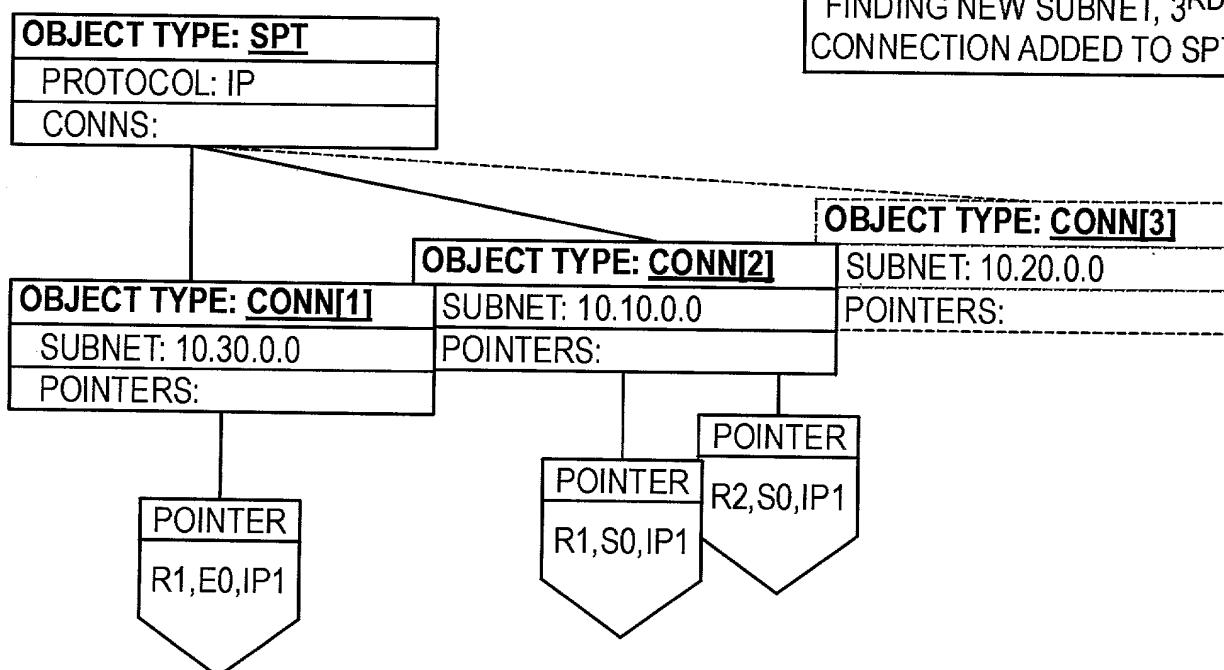


FIG. 8G

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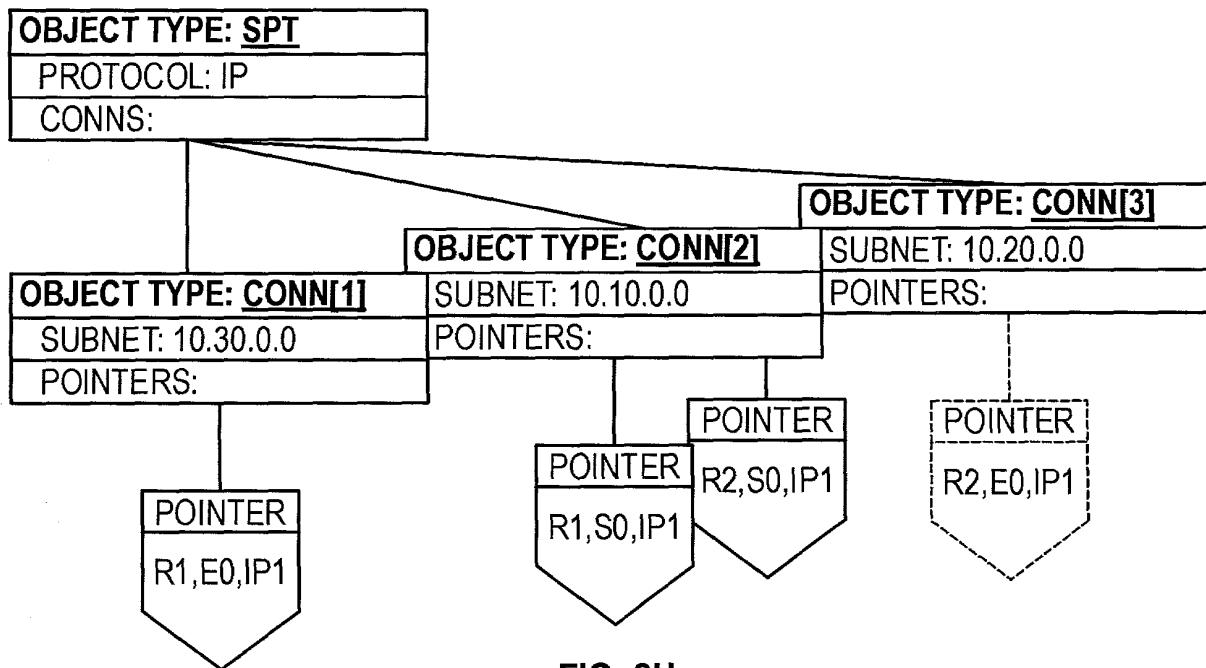


FIG. 8H

404-4

PORT ADDRESS FOR SUBNET  
10.20.0.0 ENCOUNTERED,  
POINTER ADDED TO SPT

407-4

LAST PORT ADDRESS  
ENCOUNTERED: SPT FOR IP  
COMPLETE

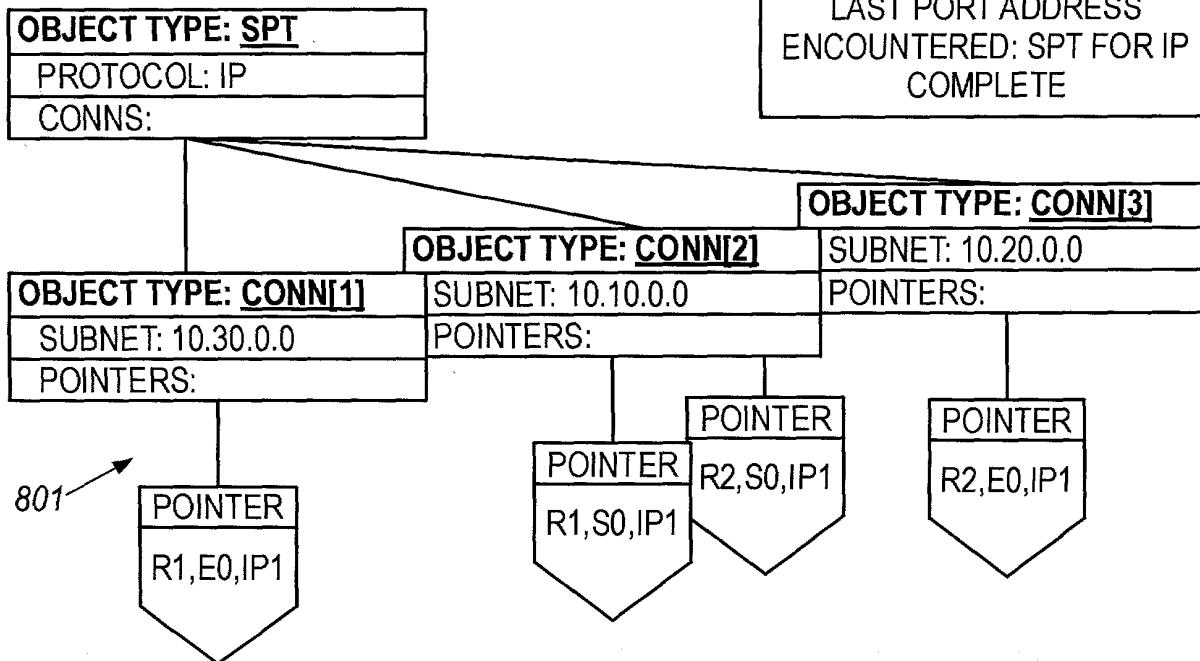


FIG. 8I

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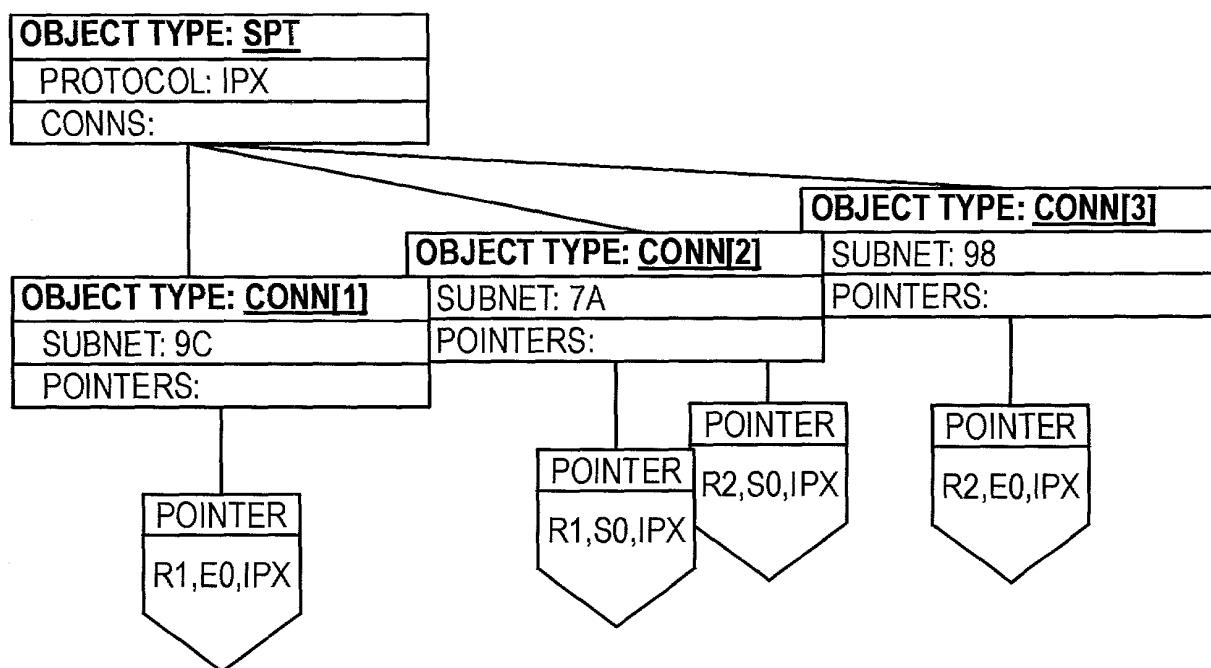


FIG. 8J

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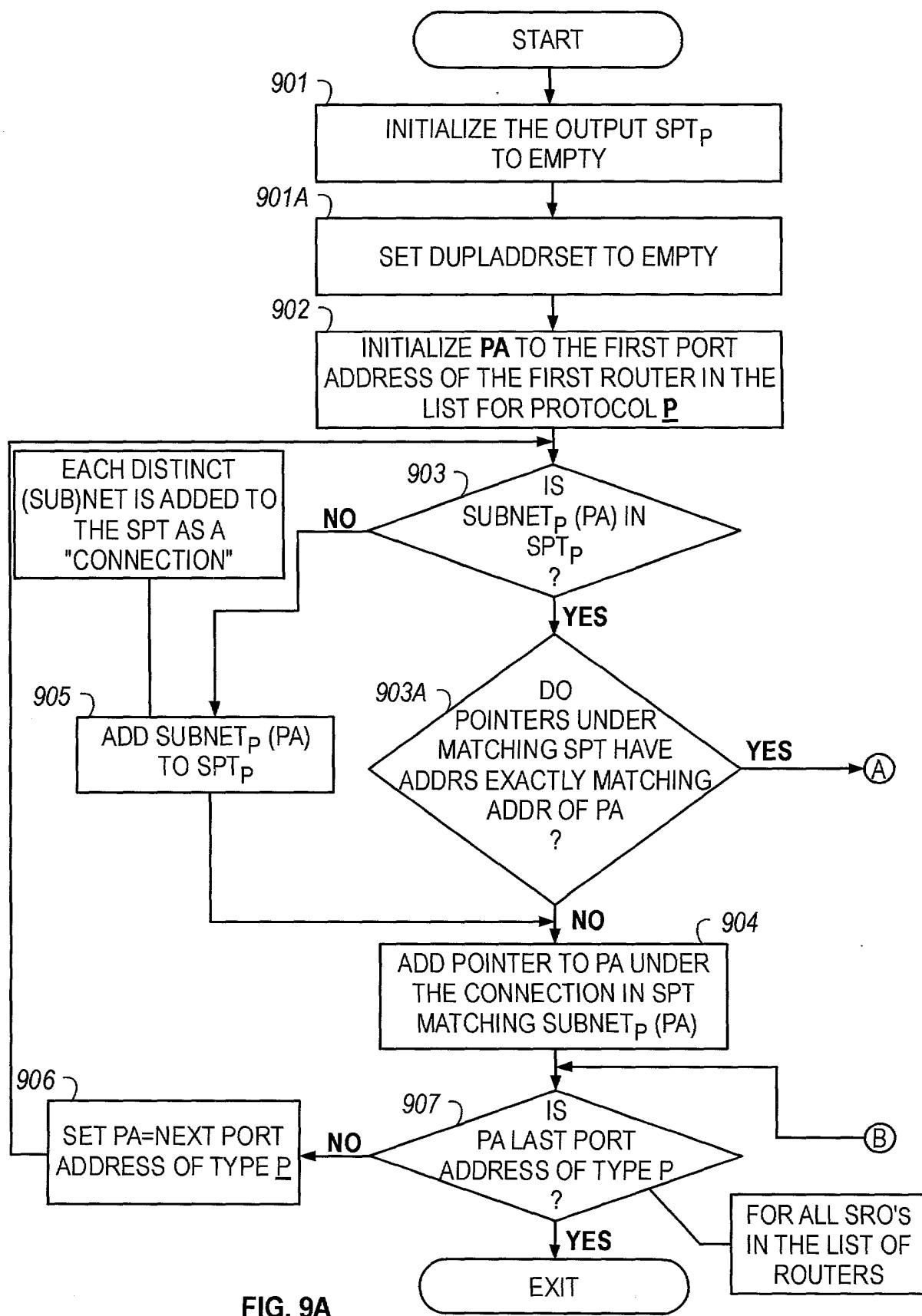


FIG. 9A

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NOTE  
AS REFERRED TO IN THIS FLOWCHART THE TERM "DUPLADDRSET"  
CONNOTES A SET OF PORT ADDRESS SETS THAT CAPTURE THE  
PORT ADDRESSES THAT EXACTLY MATCH.  
FOR EXAMPLE { {PA1, PA3, PA4} {PA9, PA7} } MEANS  
PA1, PA3, & PA4 ALL REFER TO THE EXACT SAME ADDRESS  
AND PA9 & PA7 REFER TO EXACTLY THE SAME ADDRESS

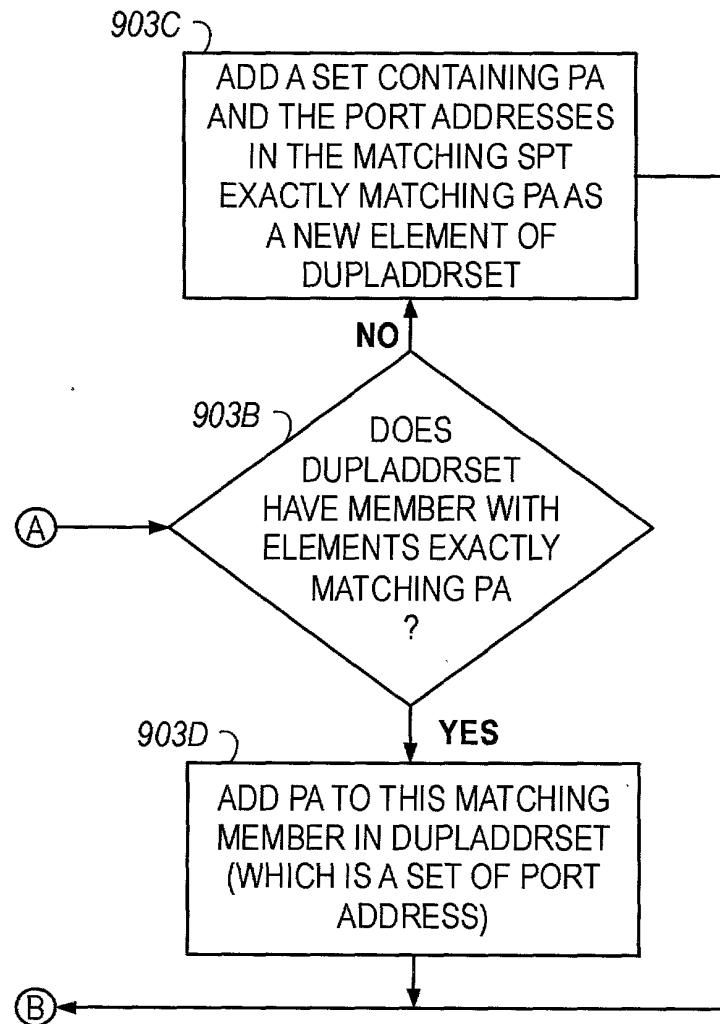


FIG. 9B

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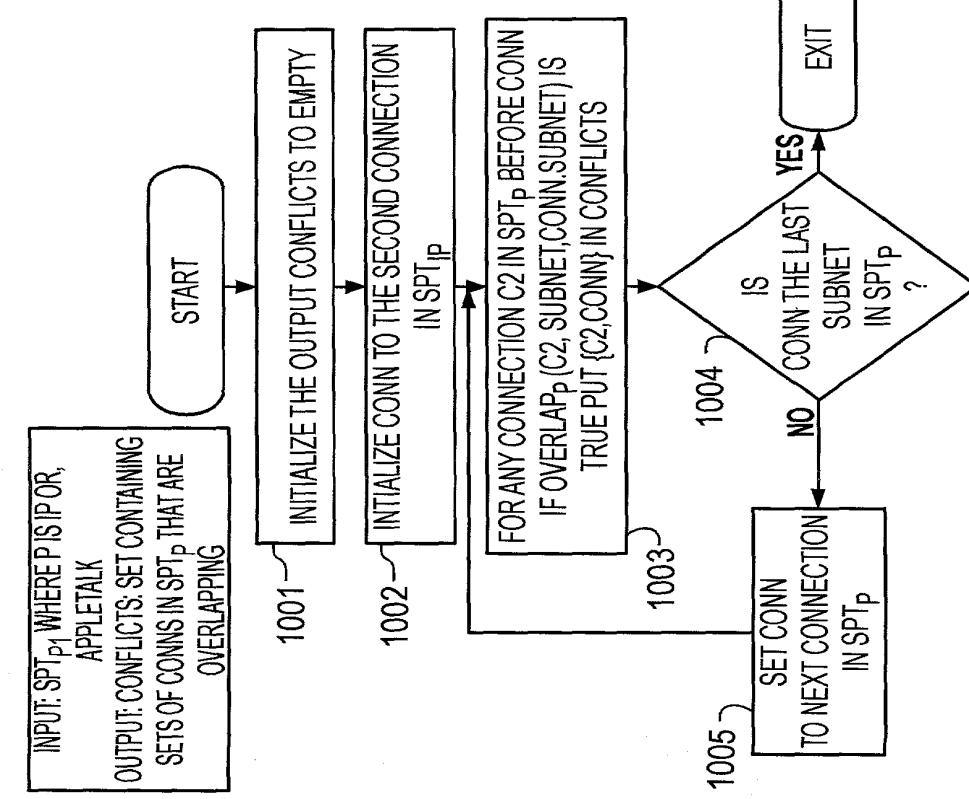
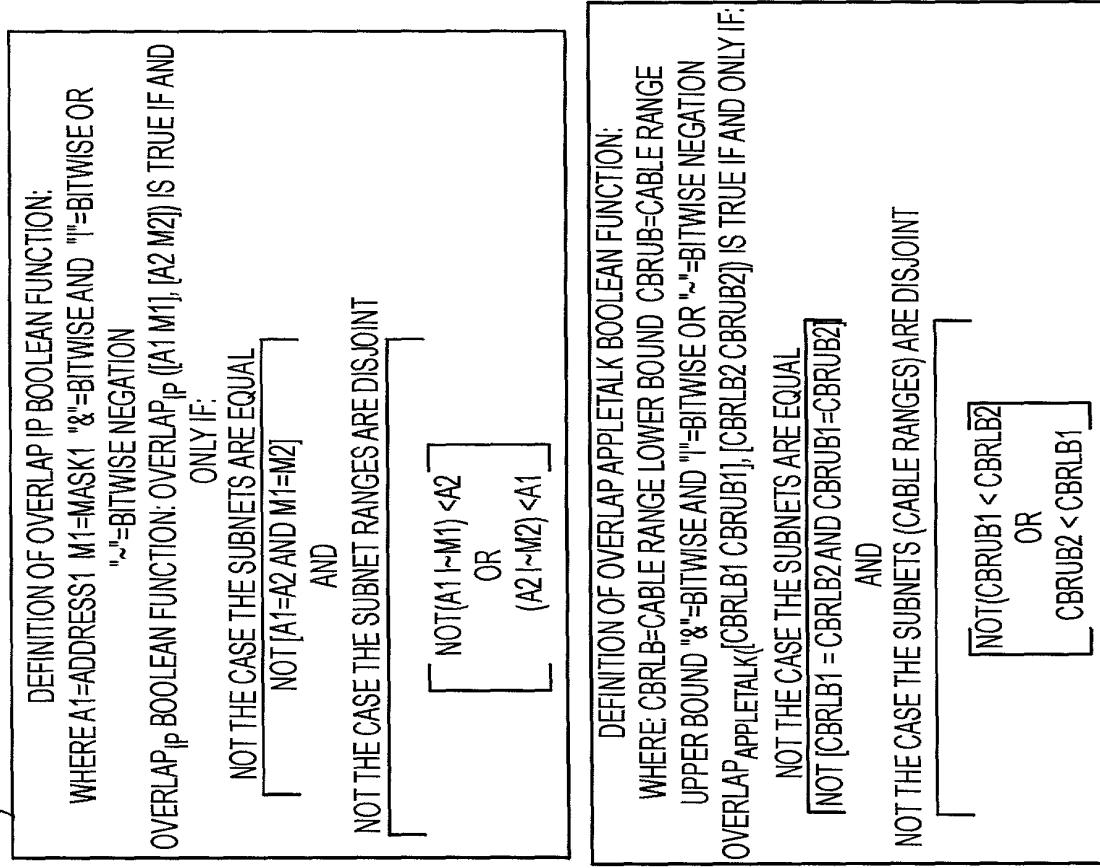


FIG. 10

1007



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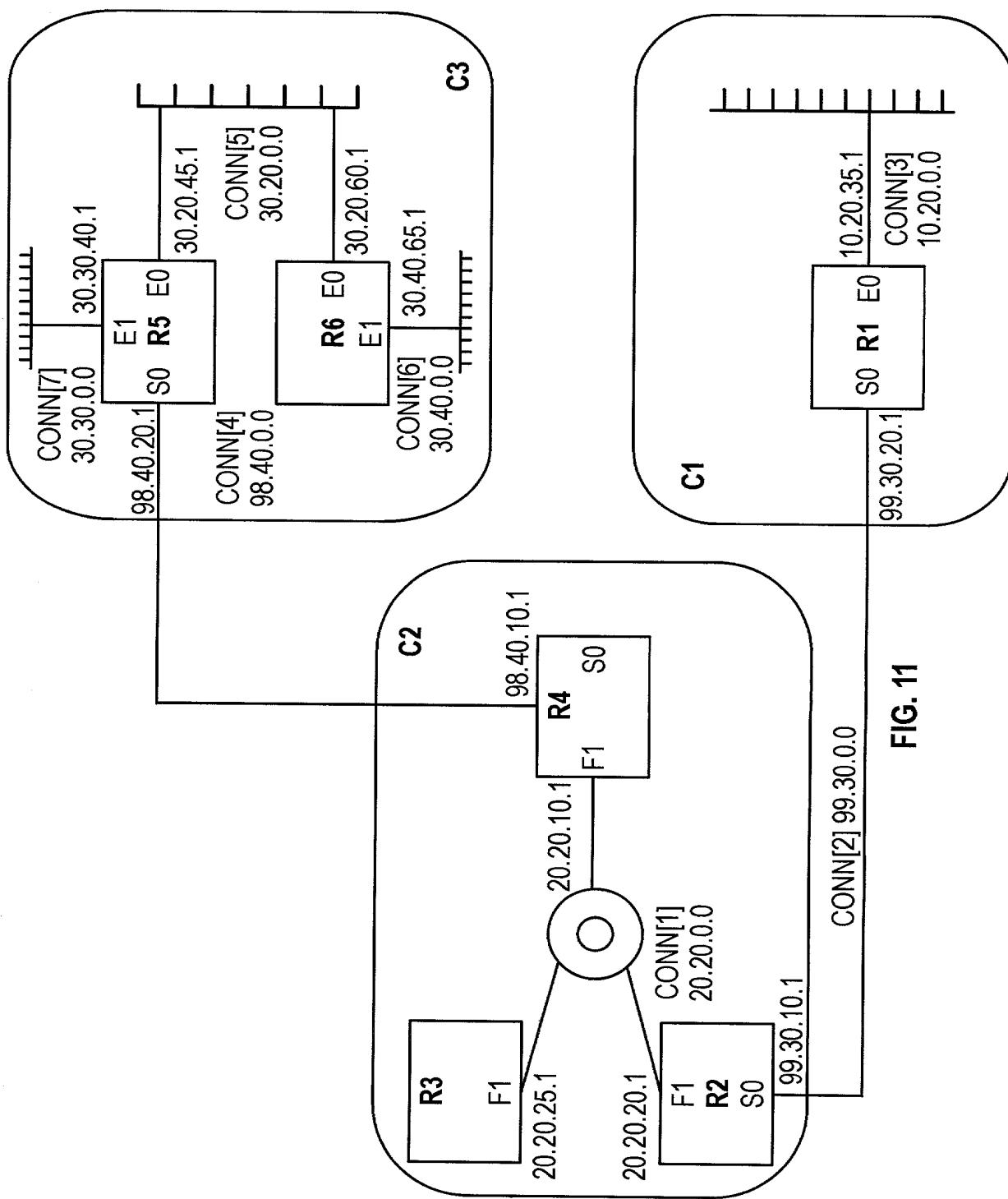


FIG. 11

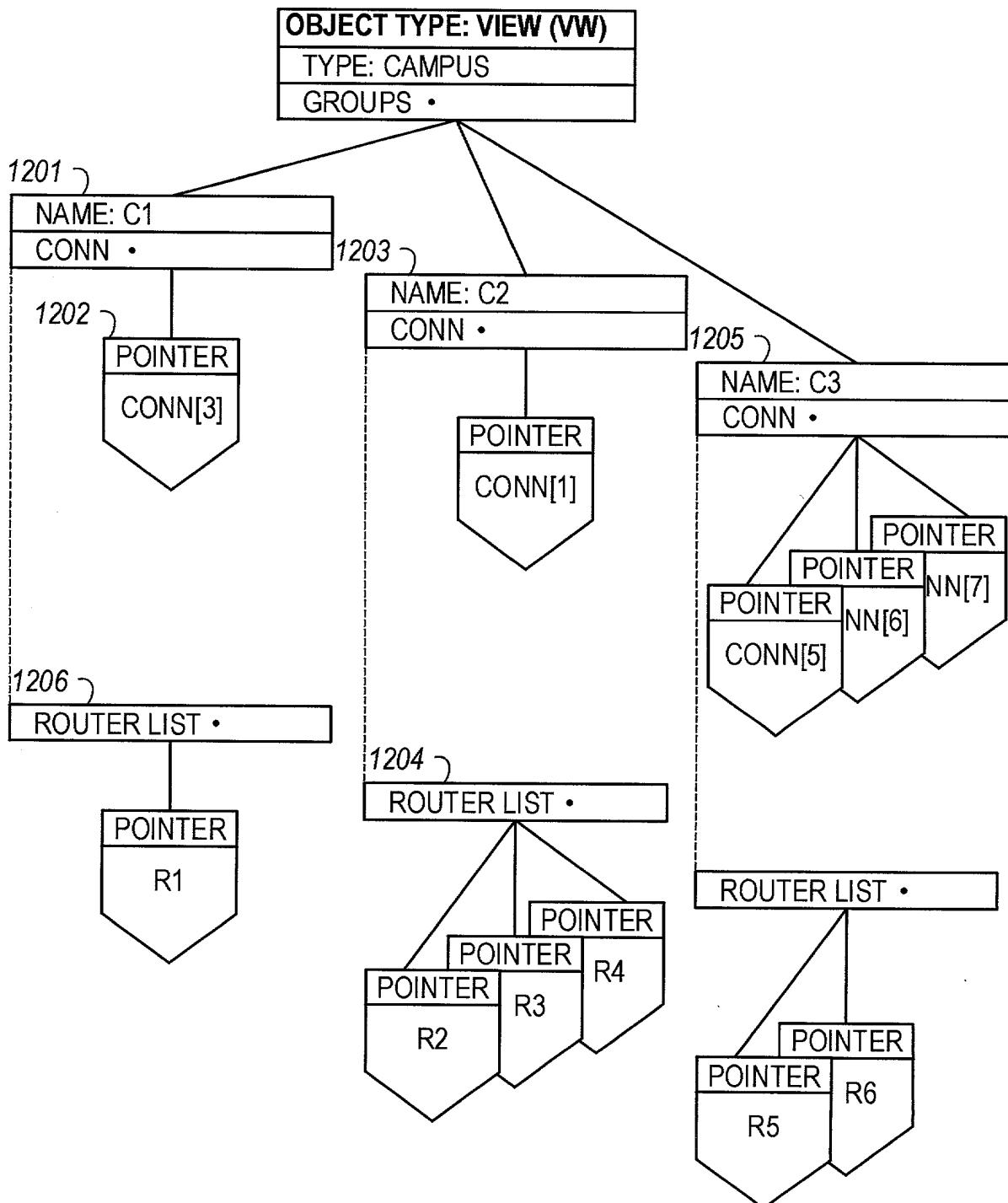


FIG. 12

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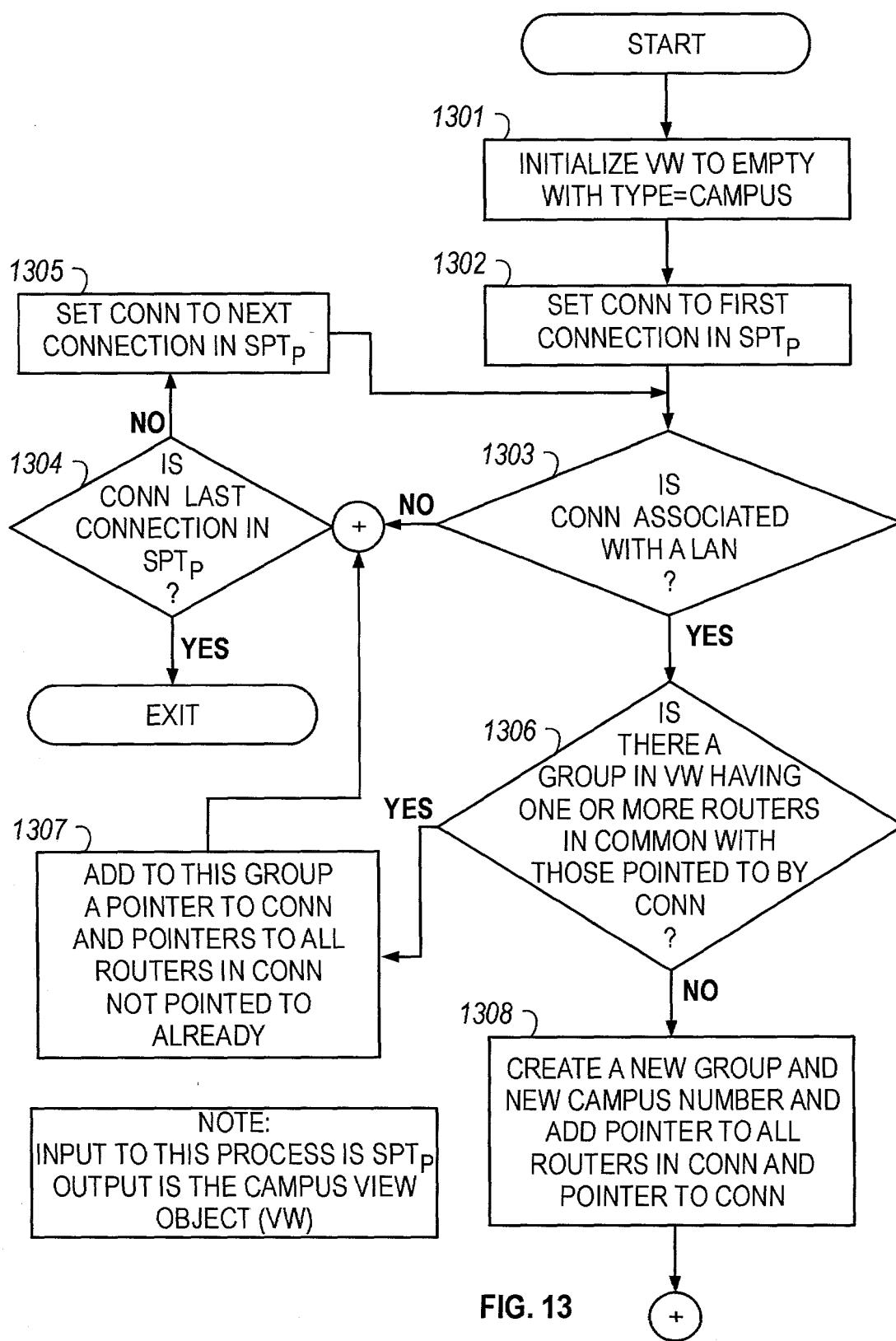


FIG. 13

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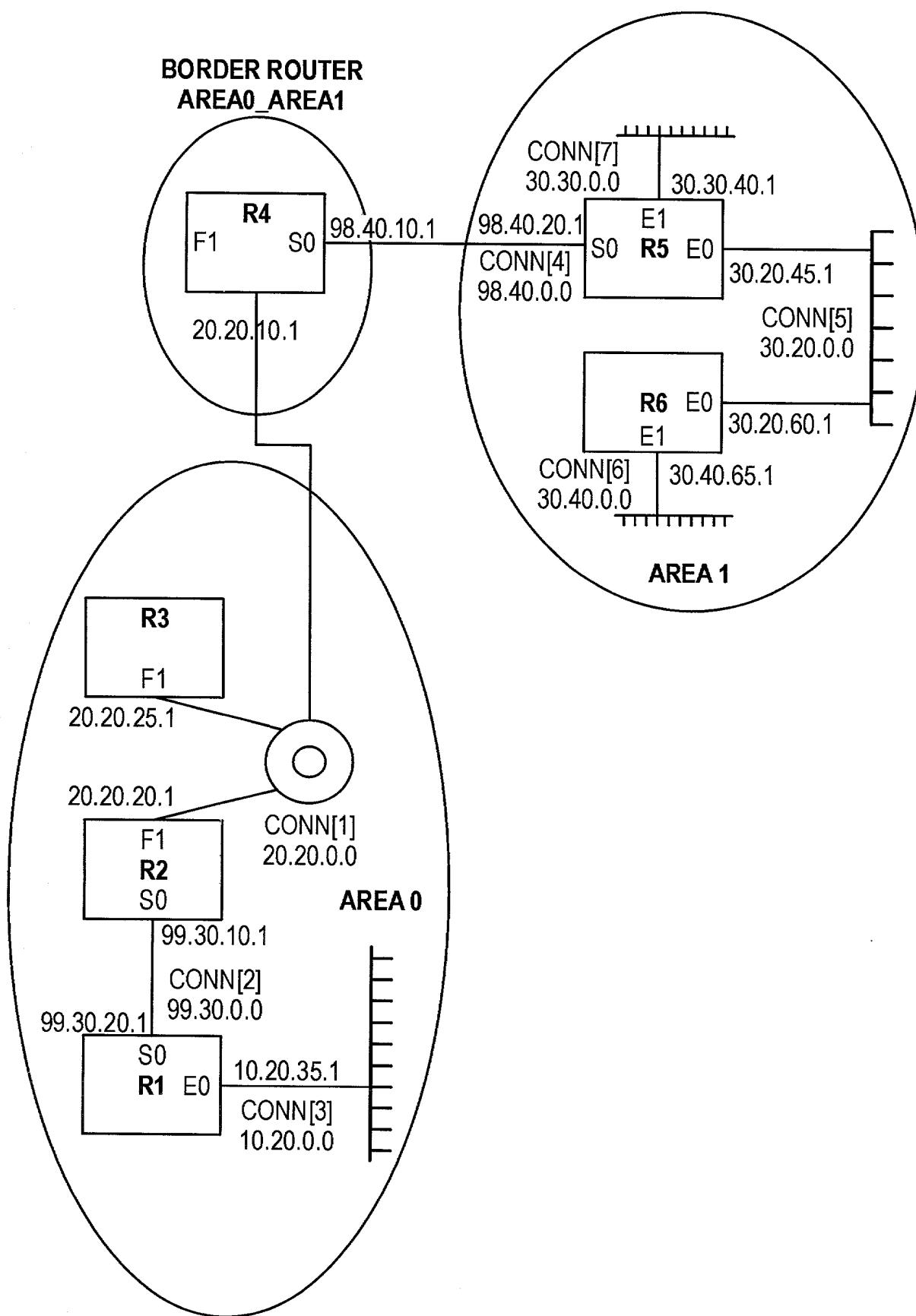


FIG. 14

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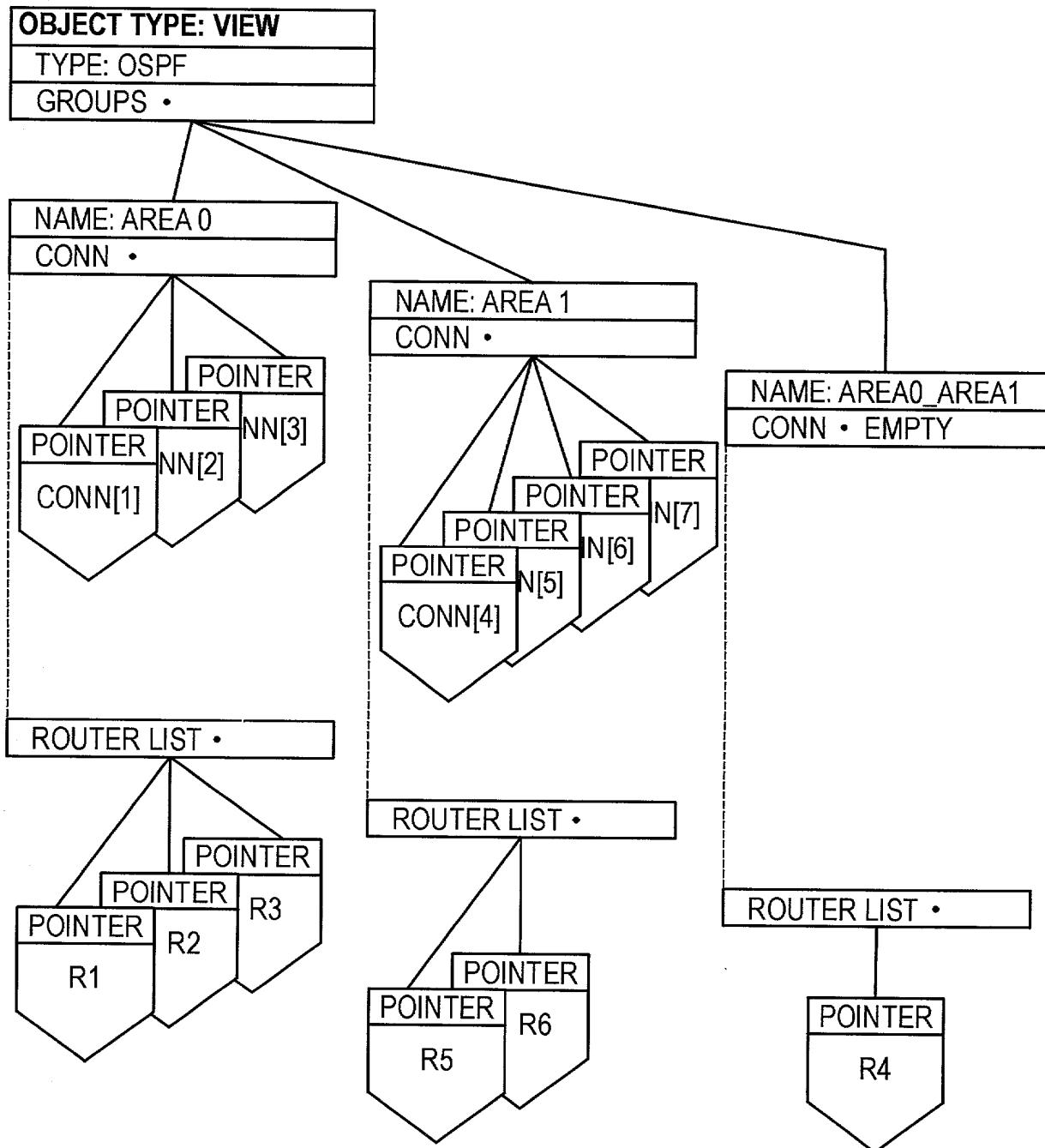


FIG. 15

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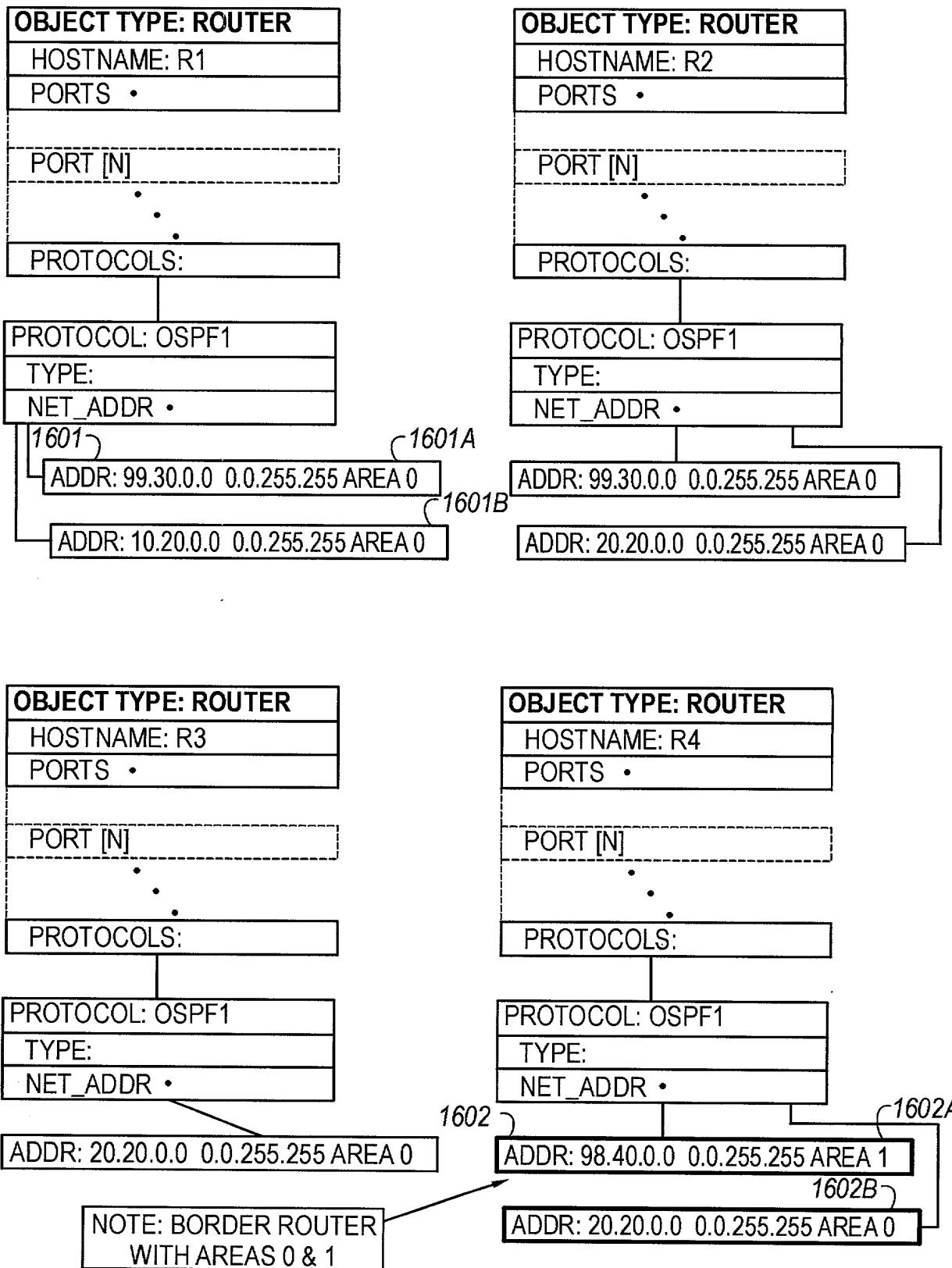


FIG. 16A

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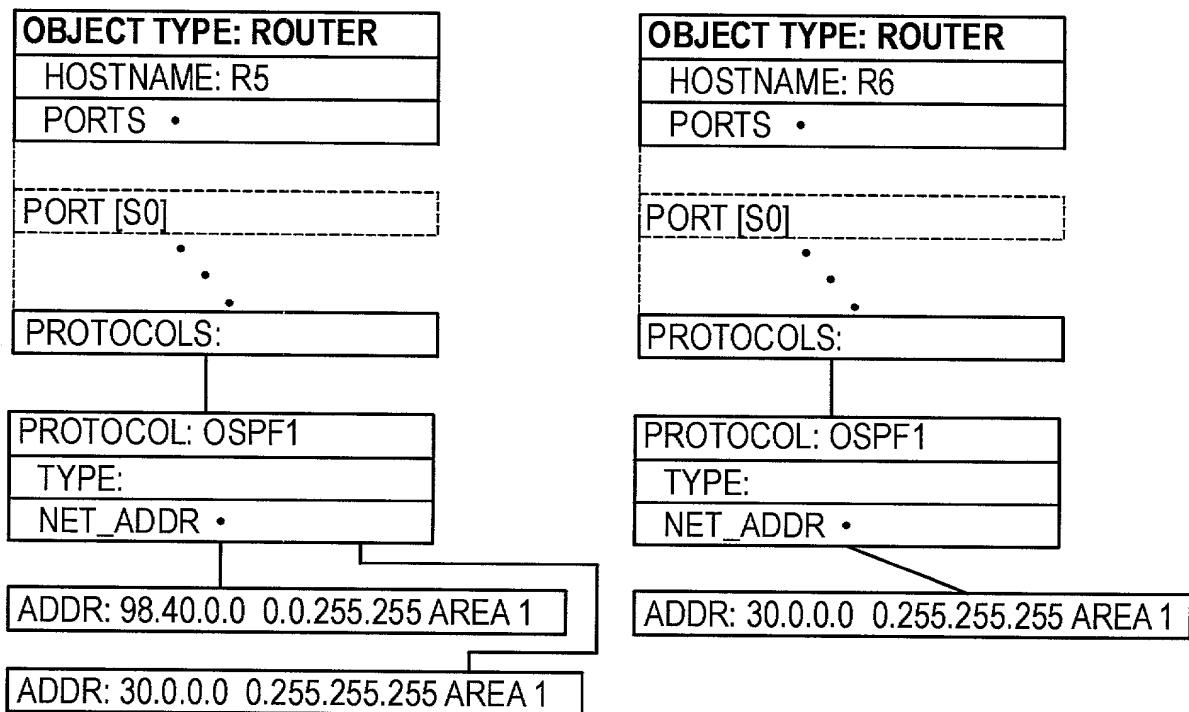
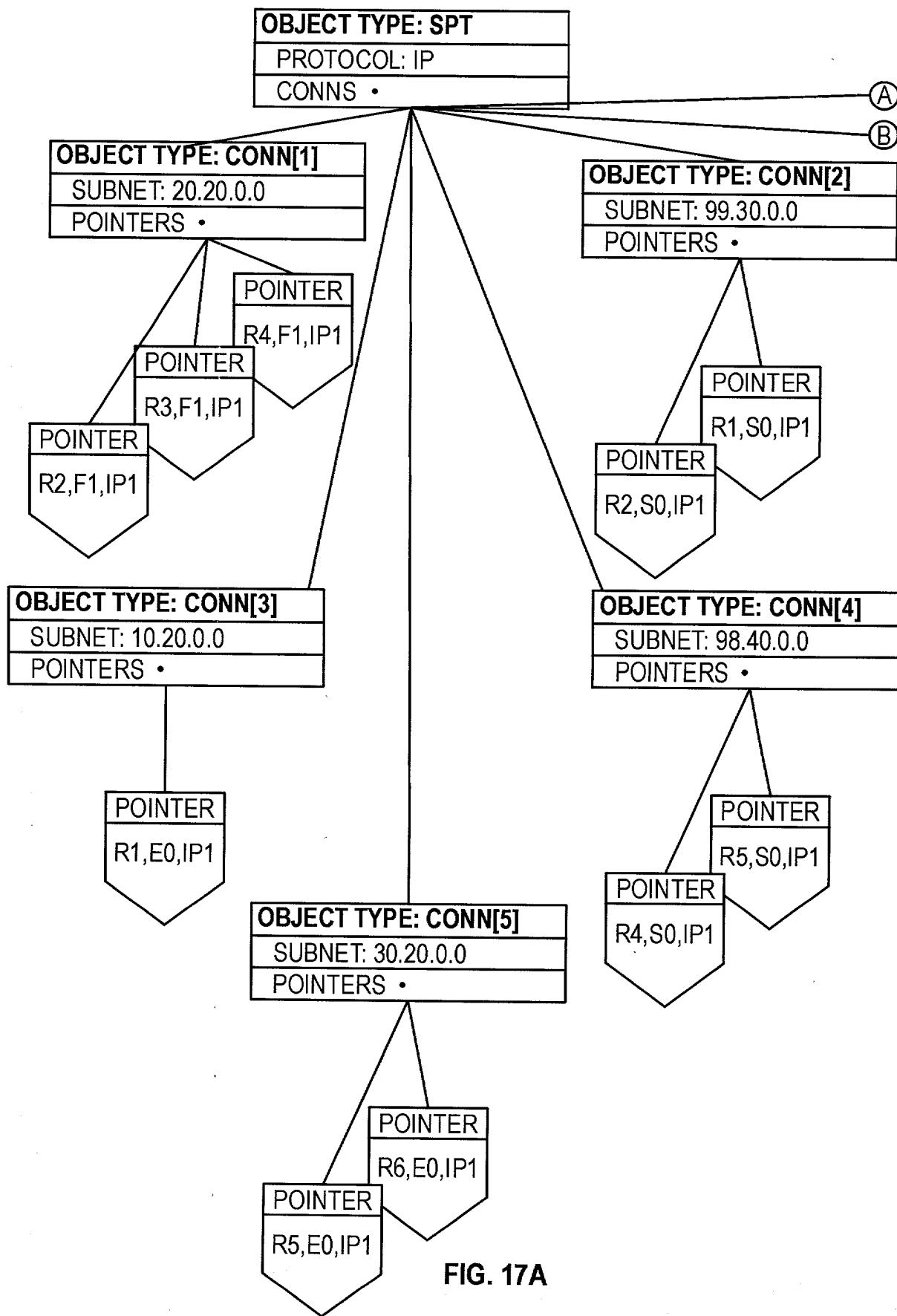


FIG. 16B

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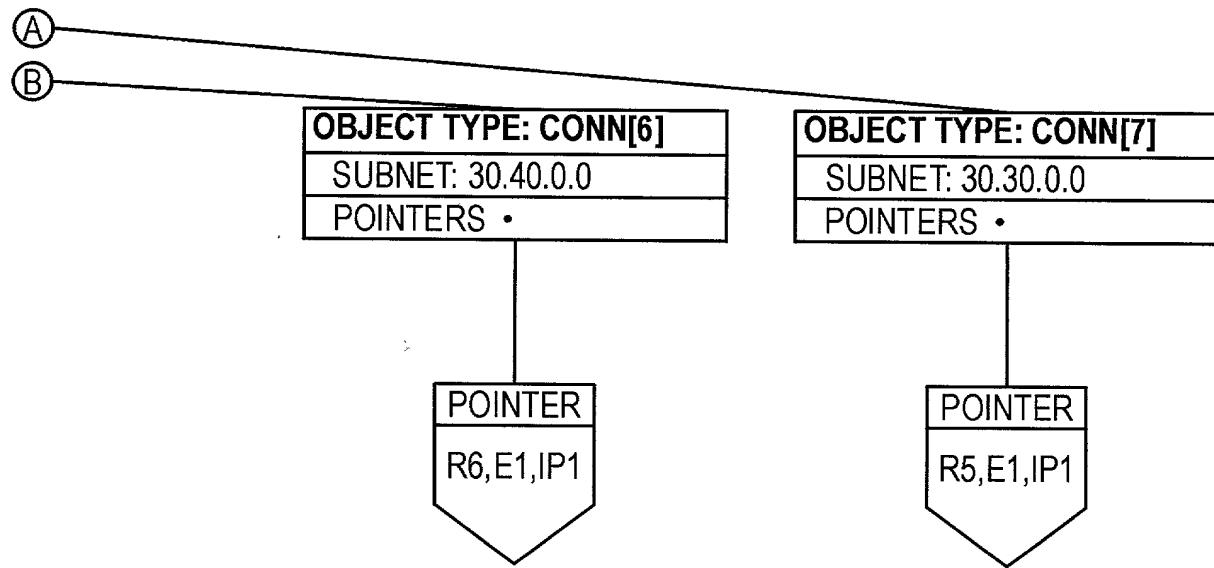


FIG. 17B

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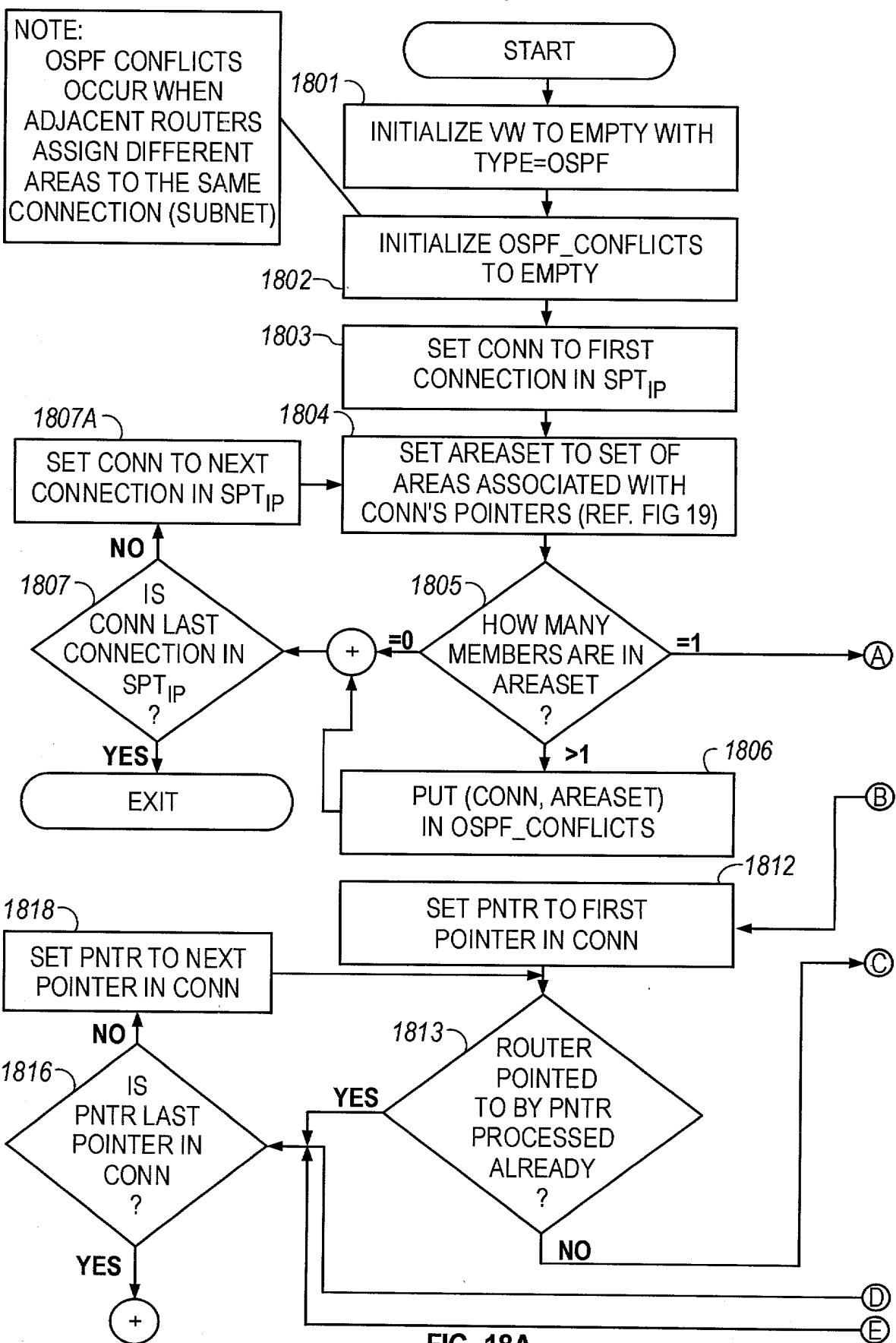


FIG. 18A

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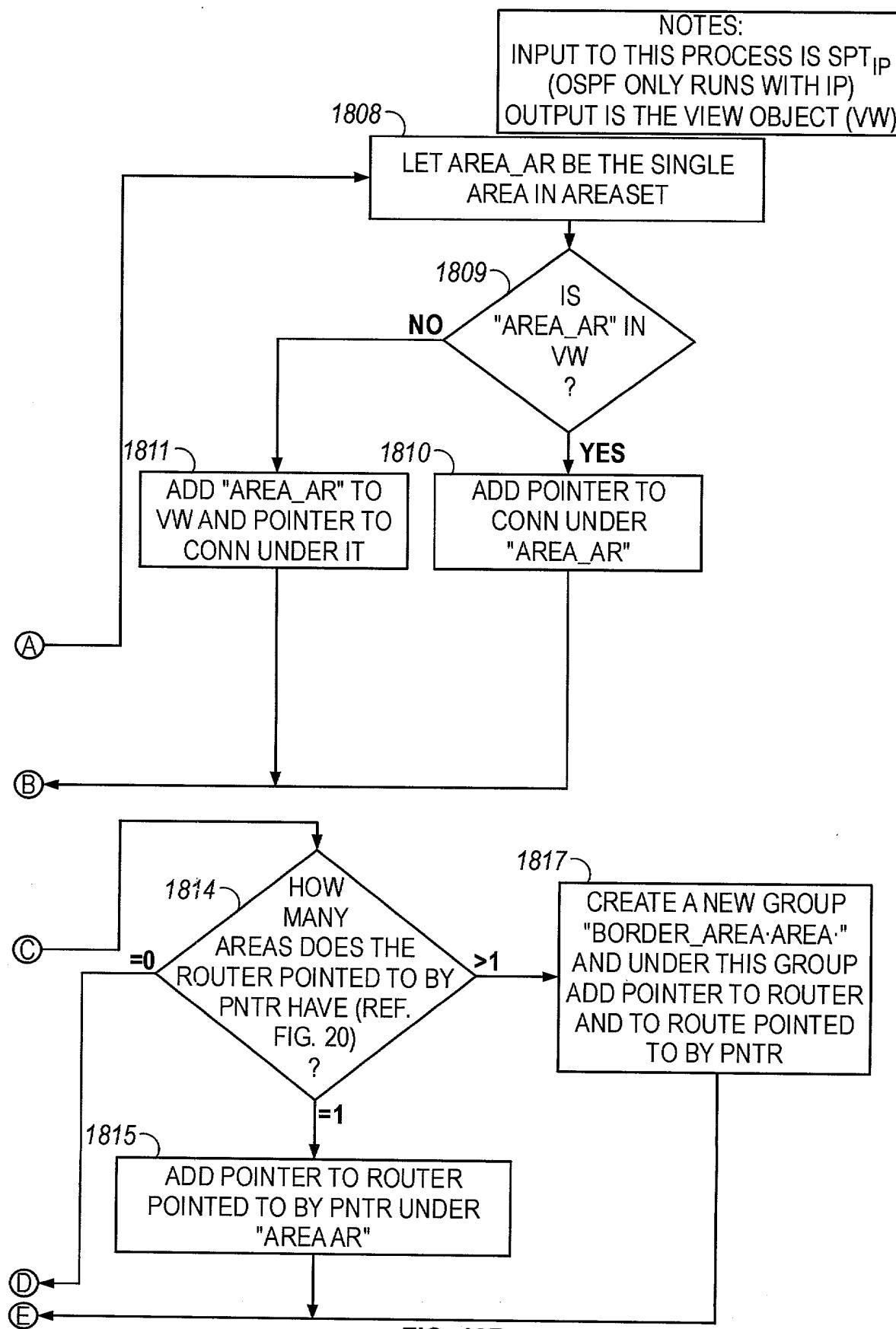


FIG. 18B

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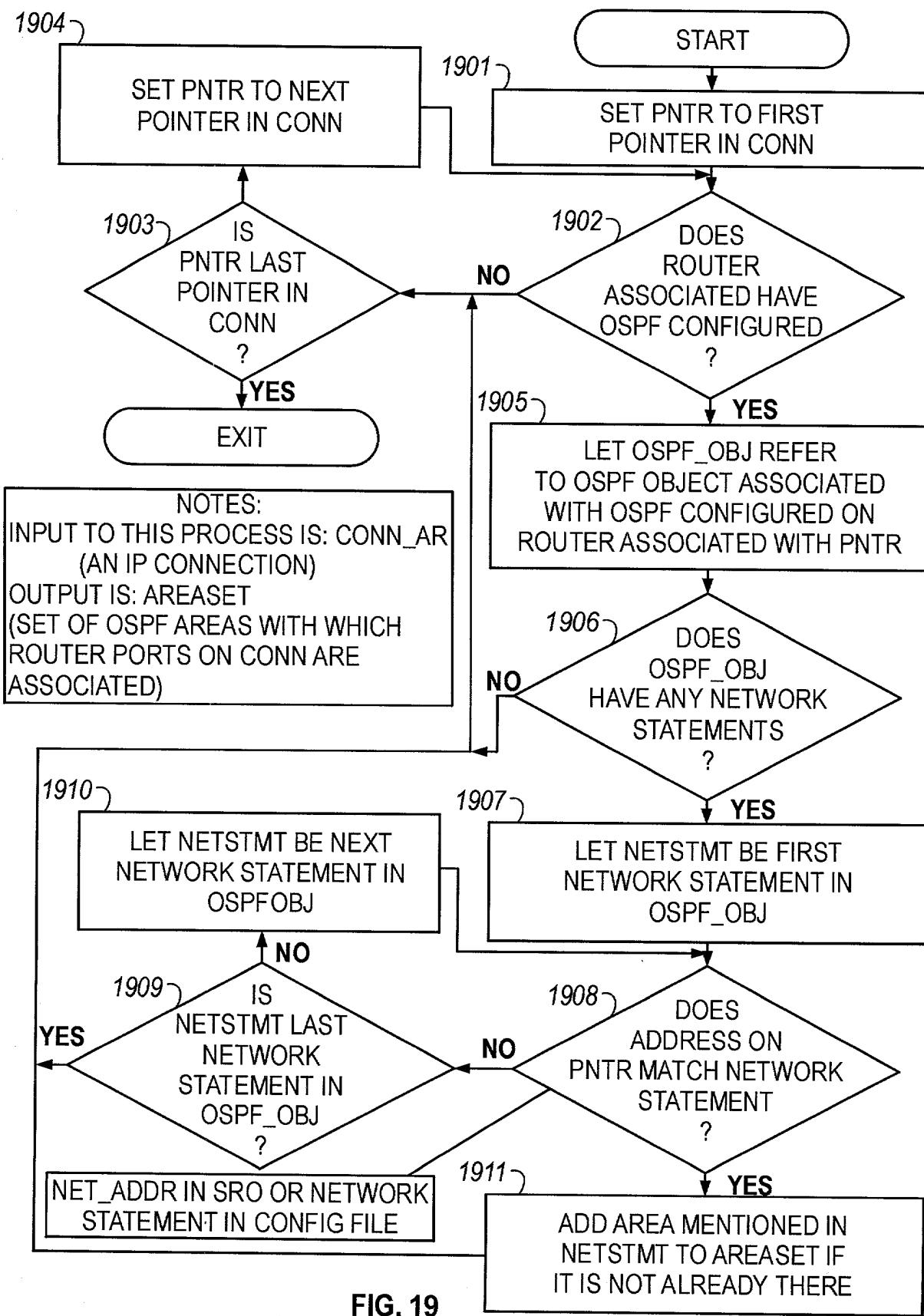


FIG. 19

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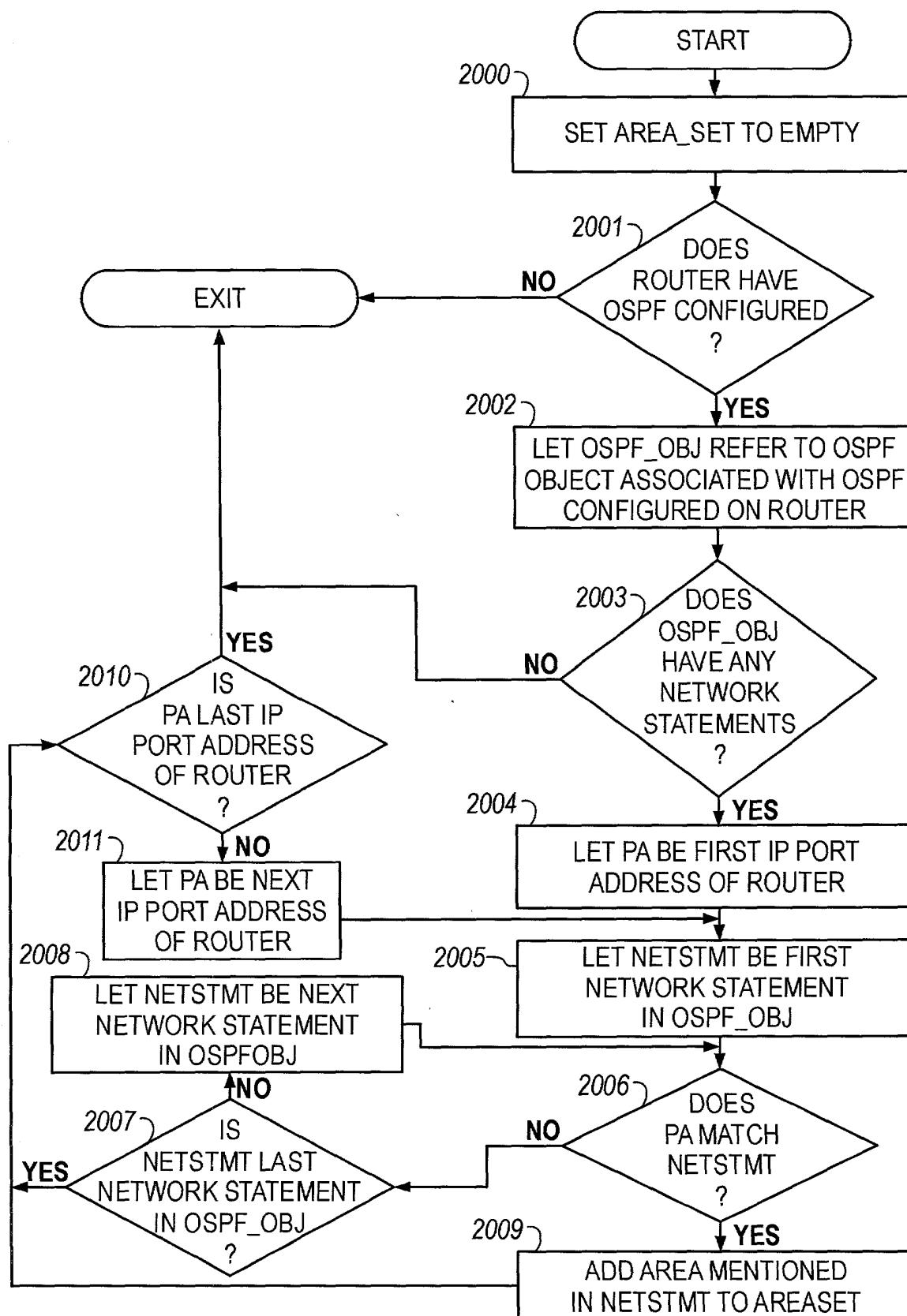


FIG. 20

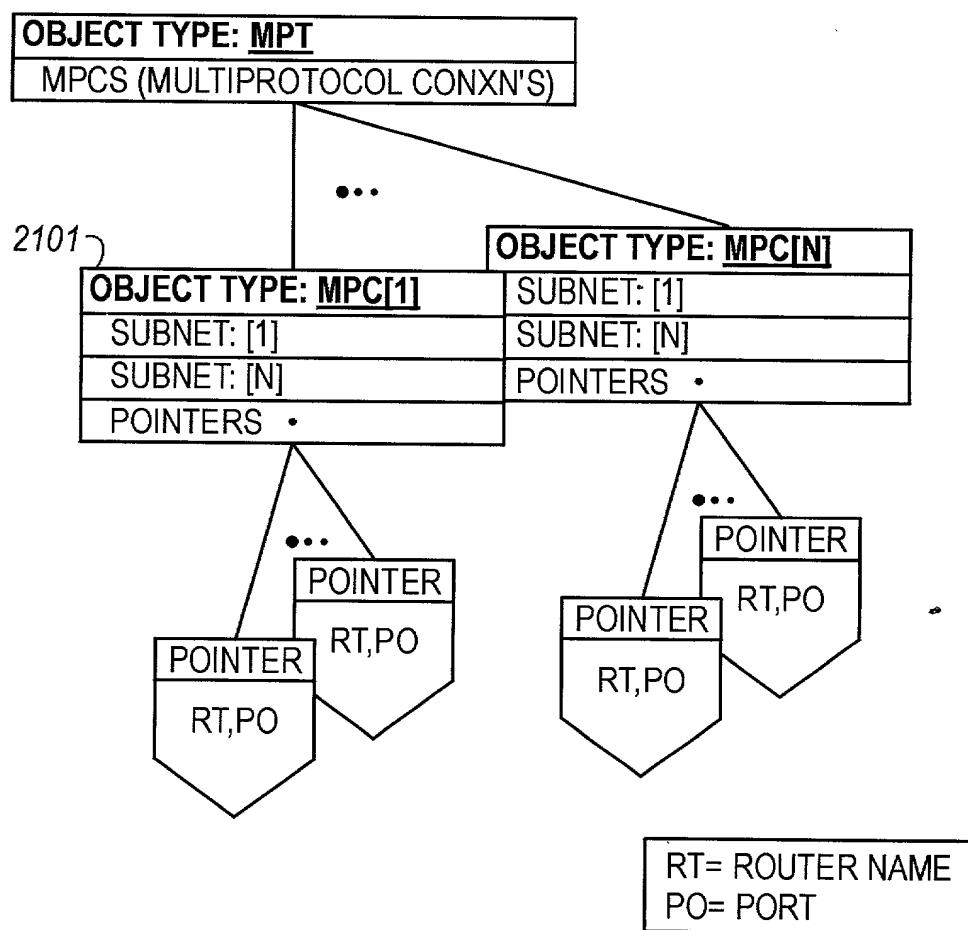


FIG. 21

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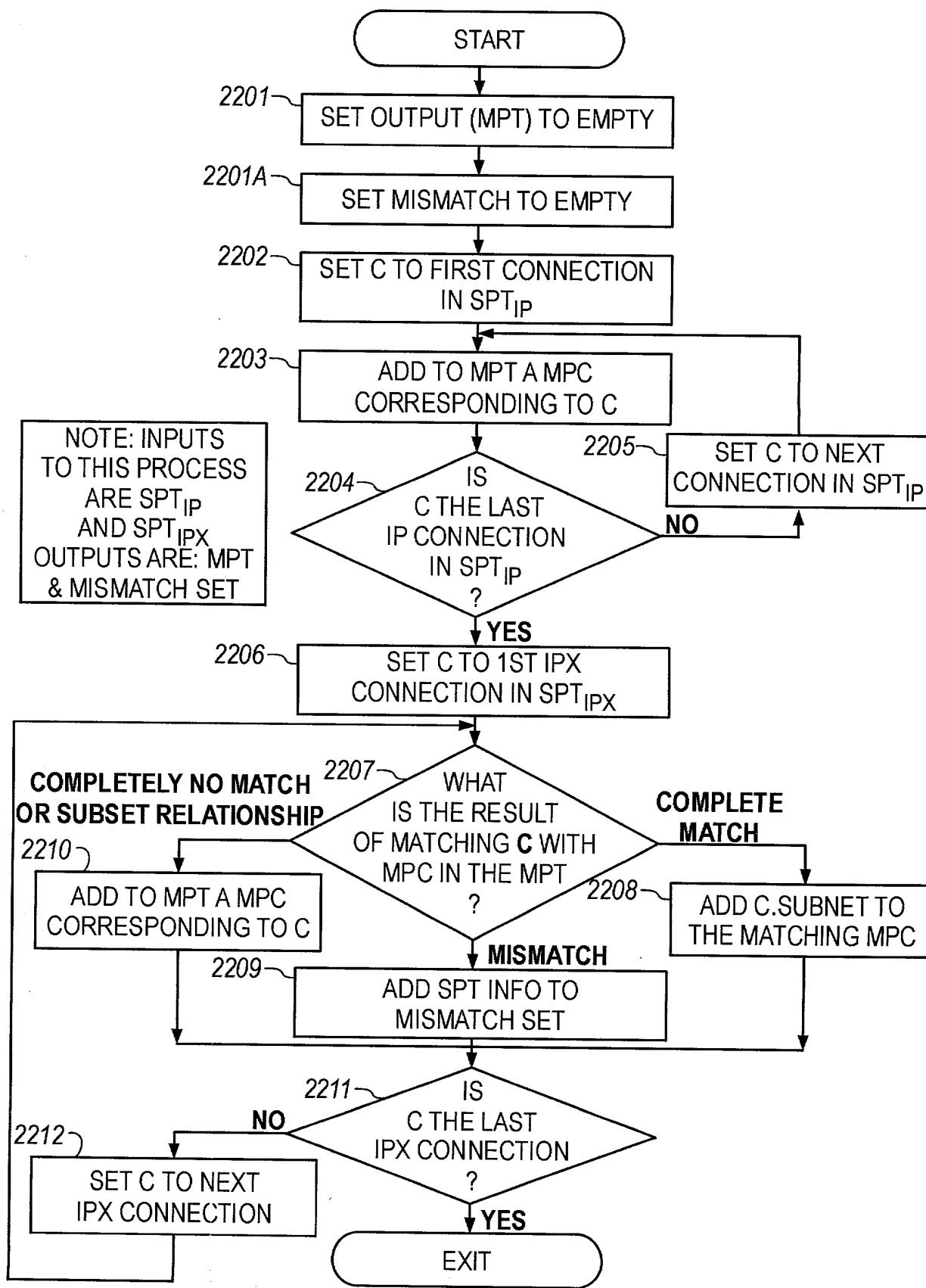


FIG. 22

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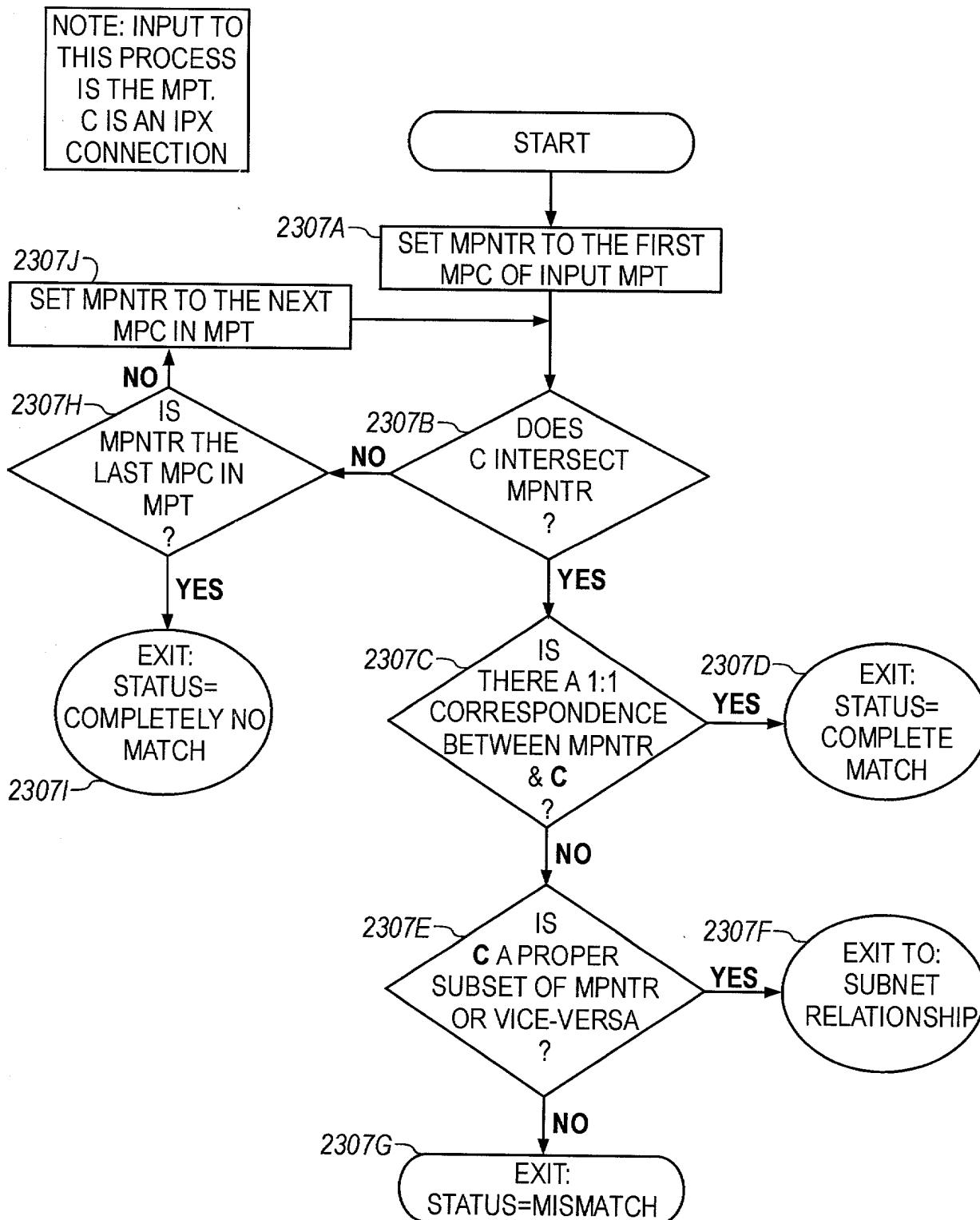


FIG. 23

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FIG. 24A

NOTE: INPUTS TO THIS PROCESS  
ARE: SPT<sub>IP</sub> AND SPT<sub>IPX</sub>

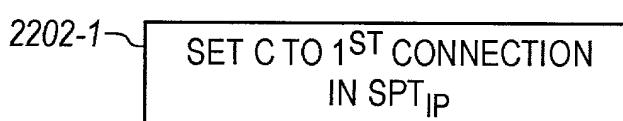
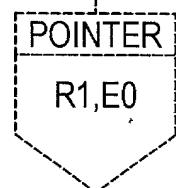
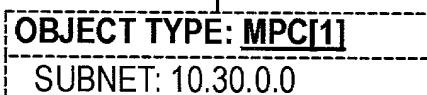
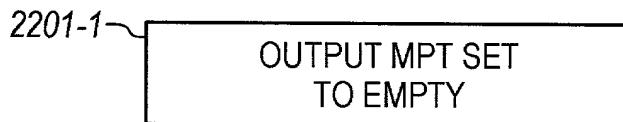


FIG. 24B



LOOPING THROUGH STEPS  
2203, 2204, 2205 ANOTHER IP  
MPC IS ADDED TO THE MPT

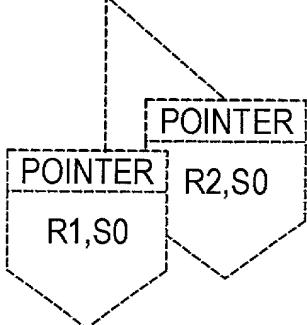
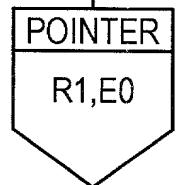
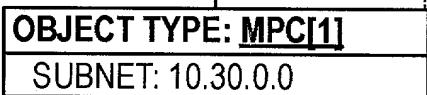


FIG. 24C

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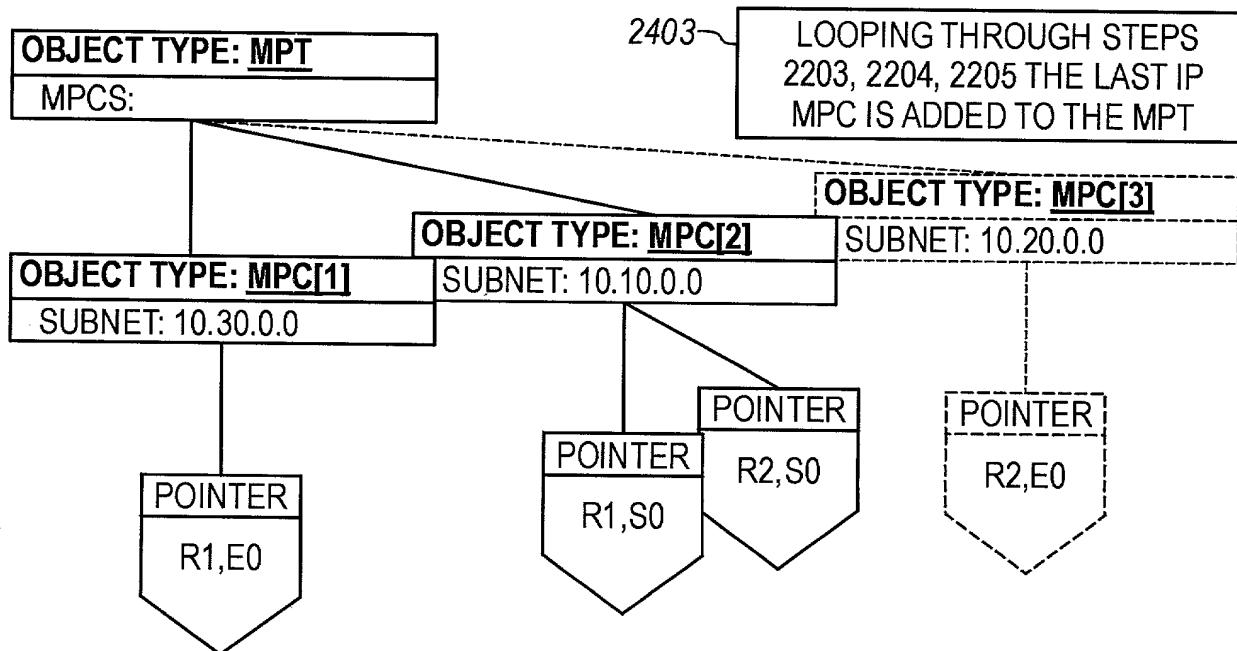


FIG. 24D

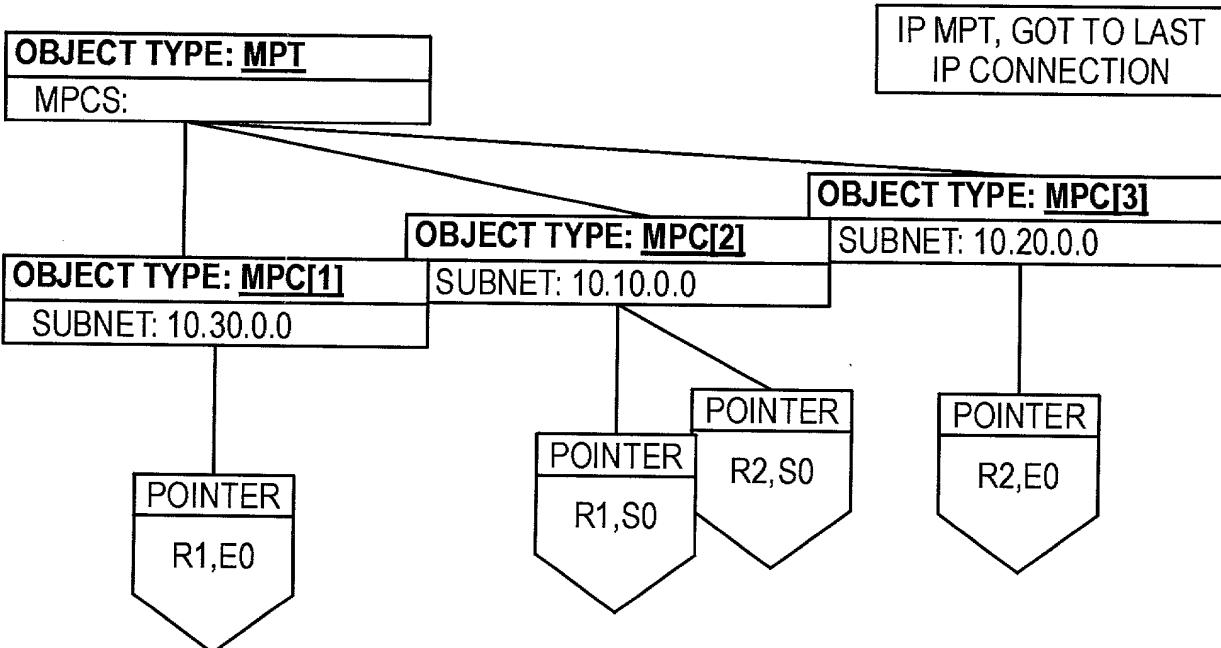


FIG. 24E

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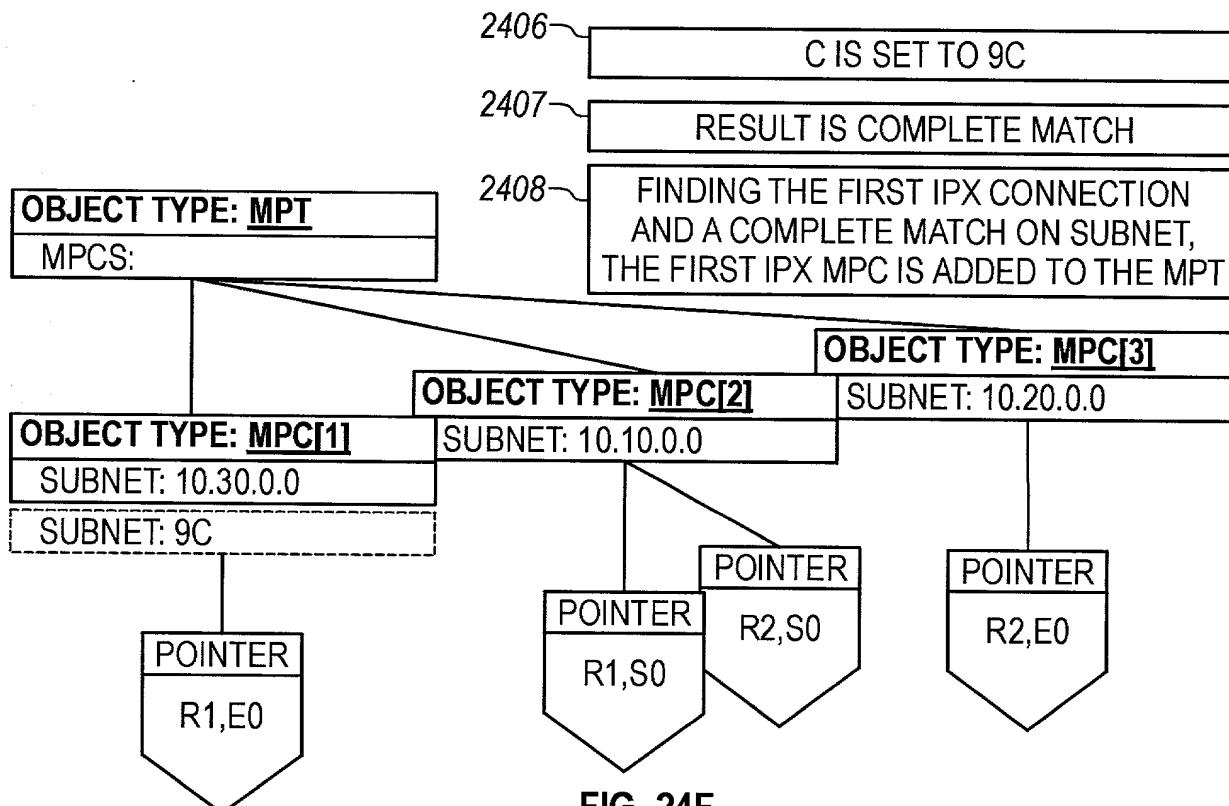


FIG. 24F

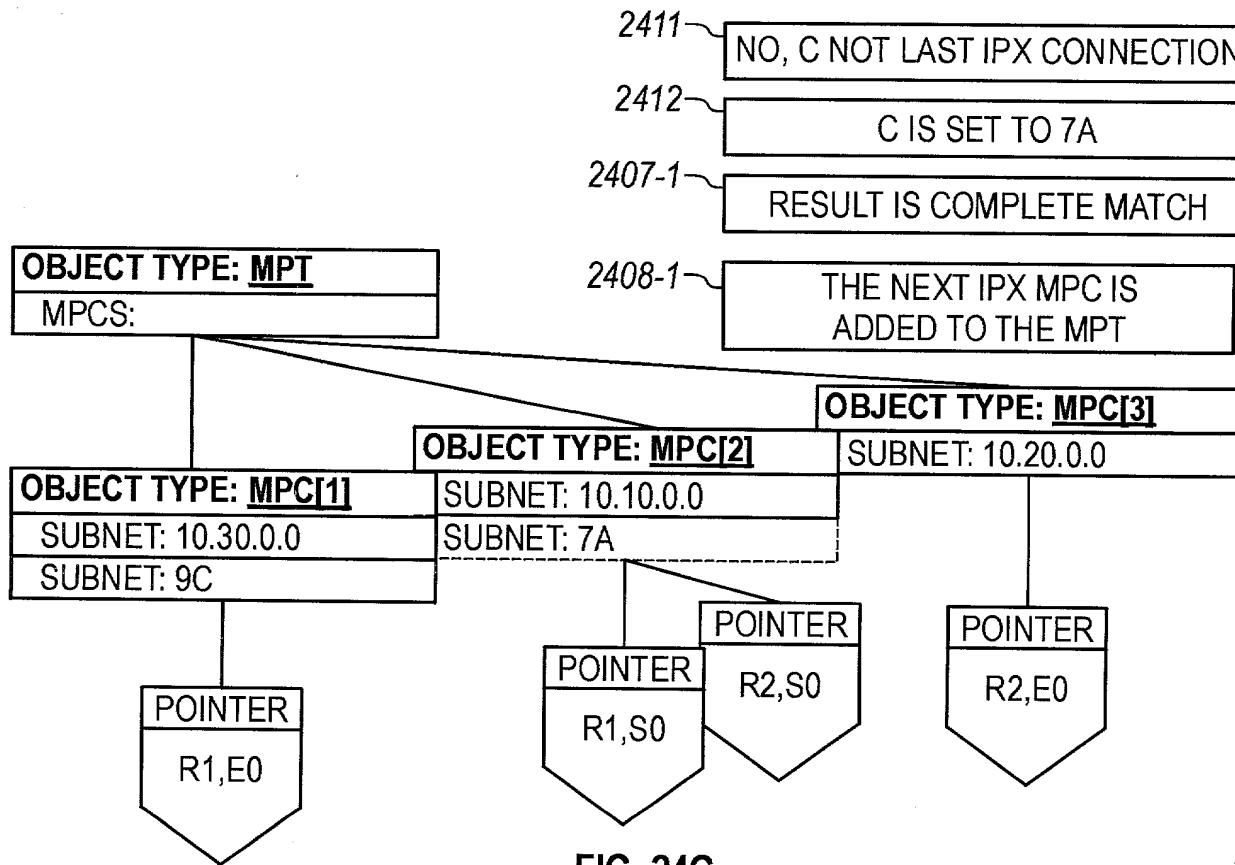
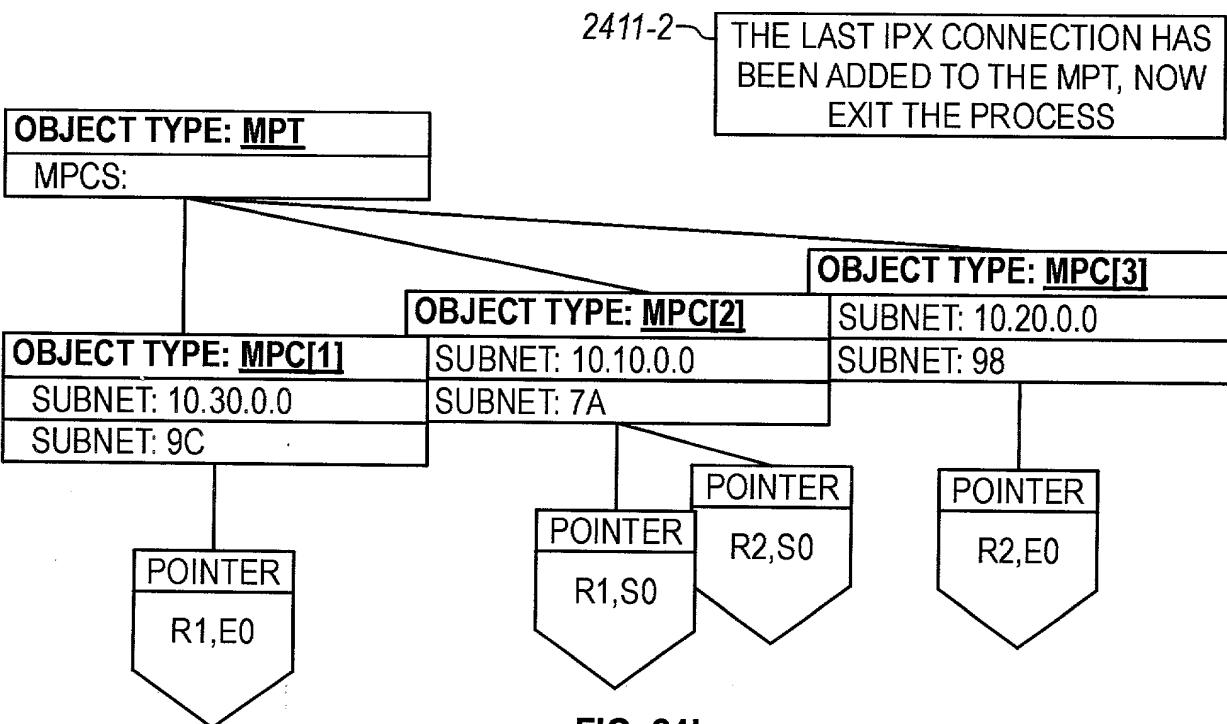
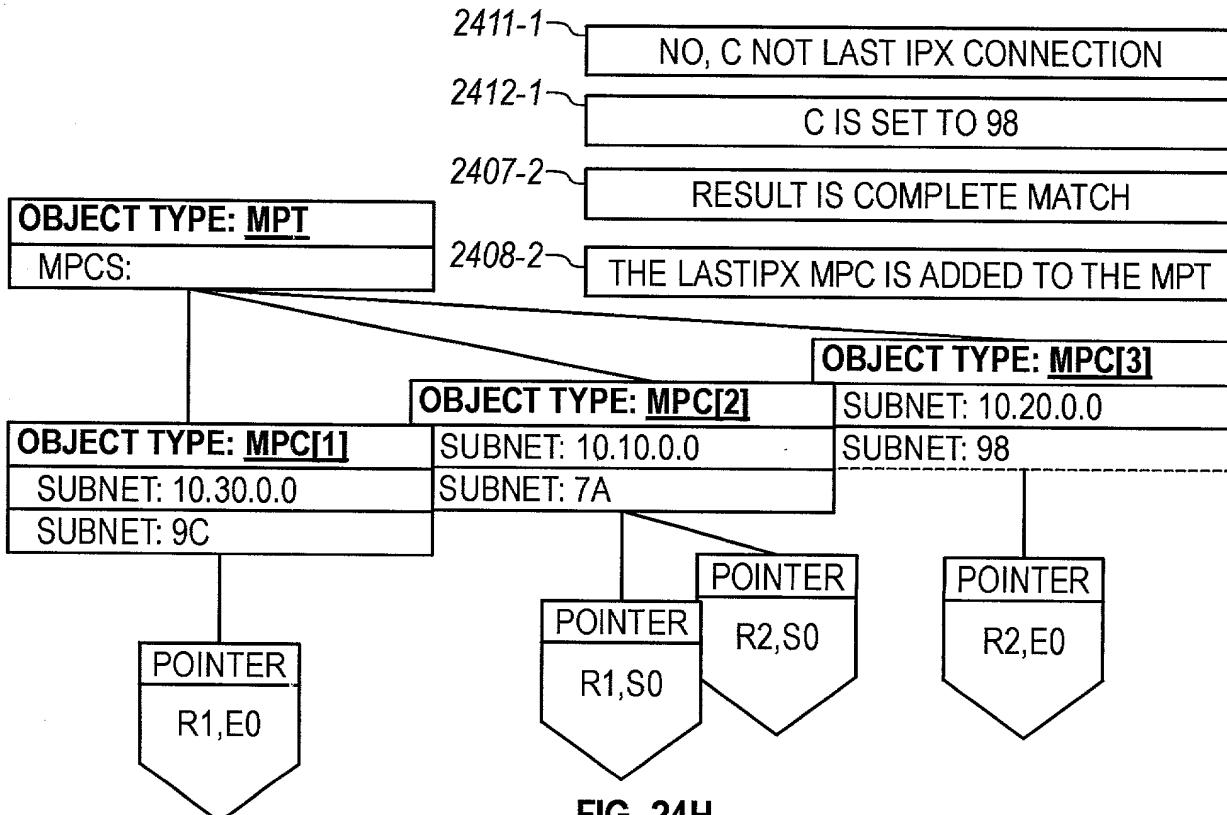


FIG. 24G

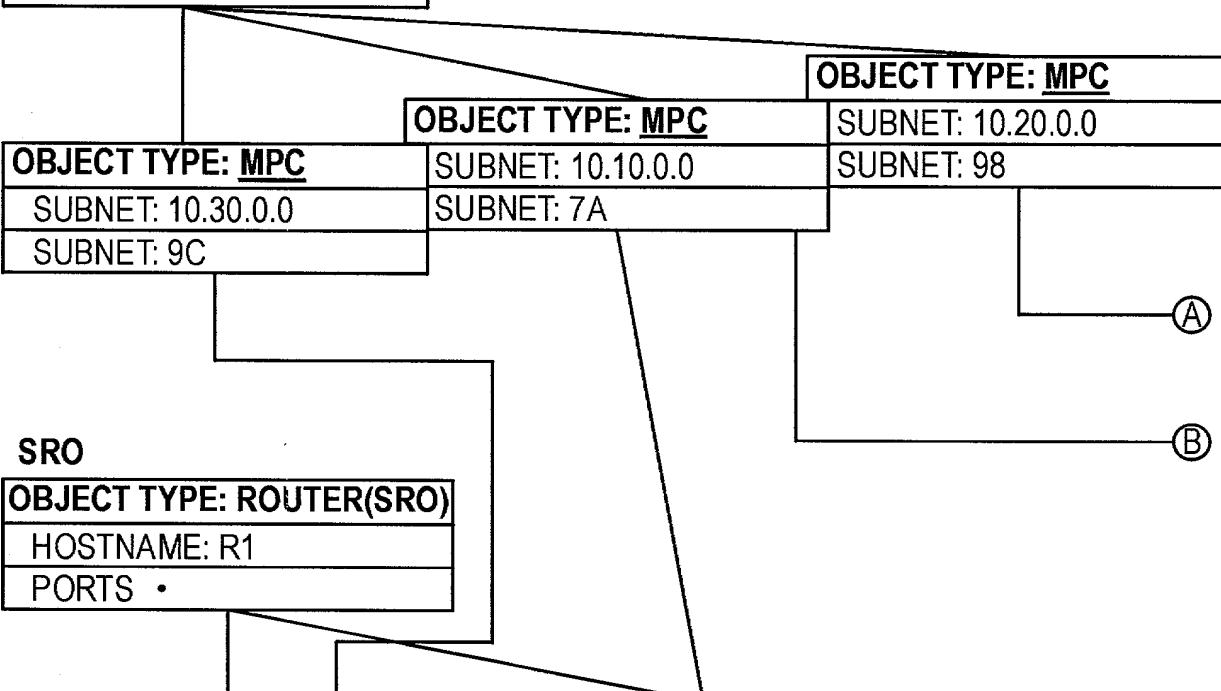
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**MPT**

<b>OBJECT TYPE: MPT</b>
MPGS:



**SRO**

<b>OBJECT TYPE: ROUTER(SRO)</b>
HOSTNAME: R1
PORTS •

<b>PORT [1] E0</b>
MEDIA TYPE: ETHERNET
NUMBER: 0
ENCAPSULATION: ARP
BANDWIDTH: 10000
DELAY: 100
PORT ADDRESSES •

<b>PORT [2] S0</b>
MEDIA TYPE: SERIAL
NUMBER: 0
ENCAPSULATION: HDLC
BANDWIDTH: 1544
DELAY: 2000
PORT ADDRESSES •

<b>PORT_ADDR [1] (R1,E0,IP1)</b>
PROTOCOL: IP
ADDR: 10.30.7.2 255.255.0.0

<b>PORT_ADDR [2] (R1,S0,IP1)</b>
PROTOCOL: IP
ADDR: 10.10.4.1 255.255.0.0

<b>PORT_ADDR [1] (R1,E0,IPX1)</b>
PROTOCOL: IPX
ADDR: 9C

<b>PORT_ADDR [2] (R1,S0,IPX1)</b>
PROTOCOL: IPX
ADDR: 7A

**FIG. 25A**

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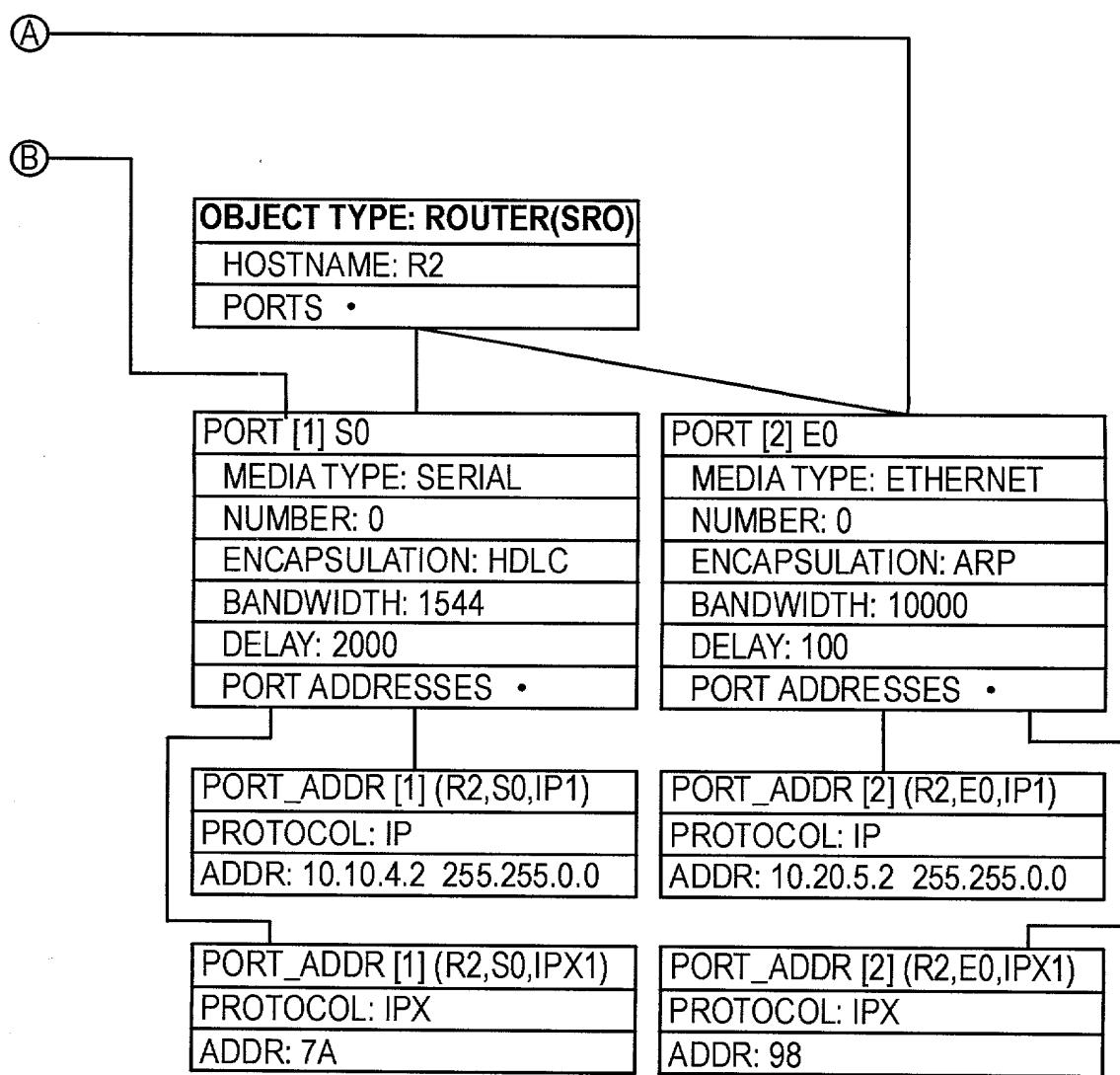


FIG. 25B

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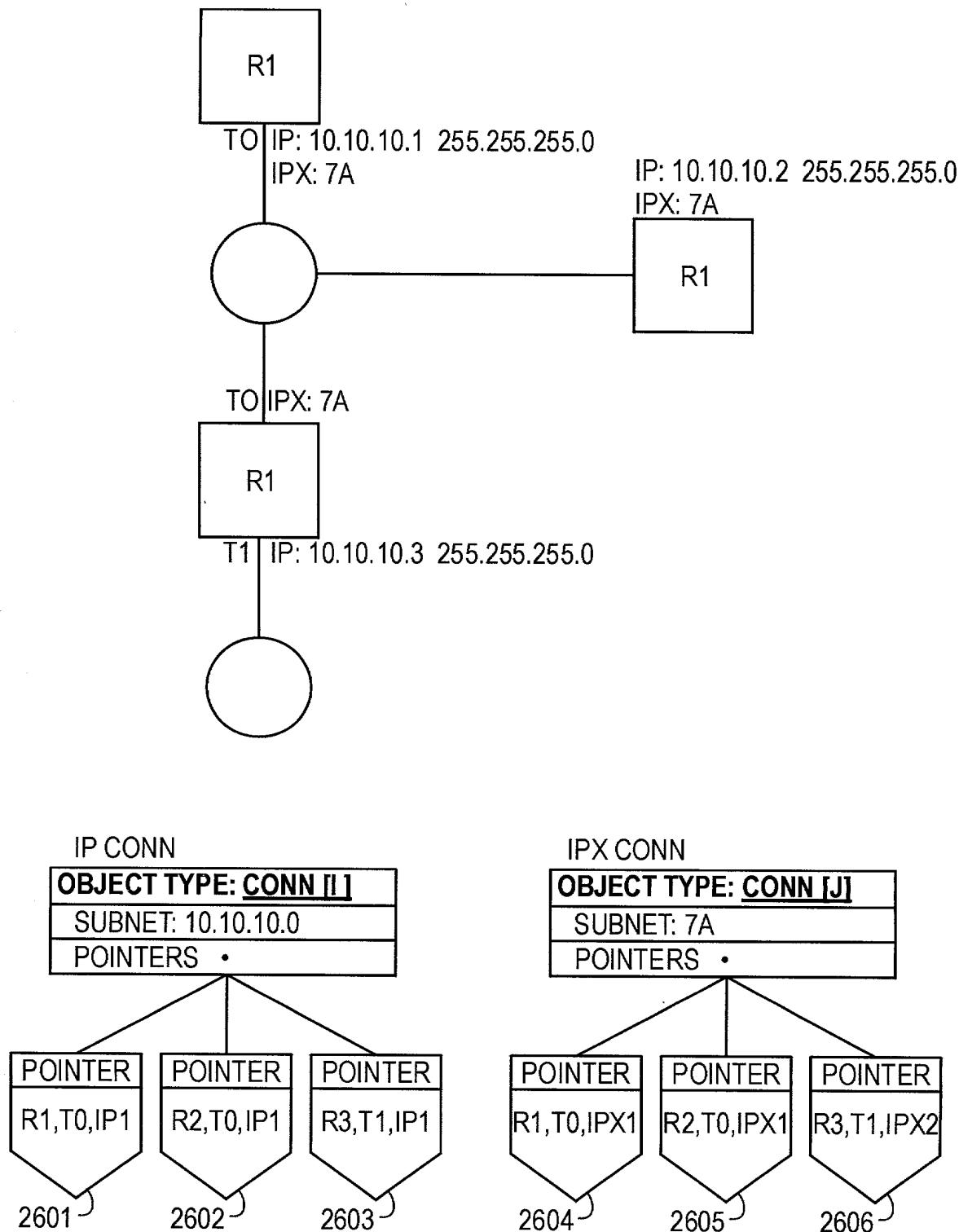


FIG. 26

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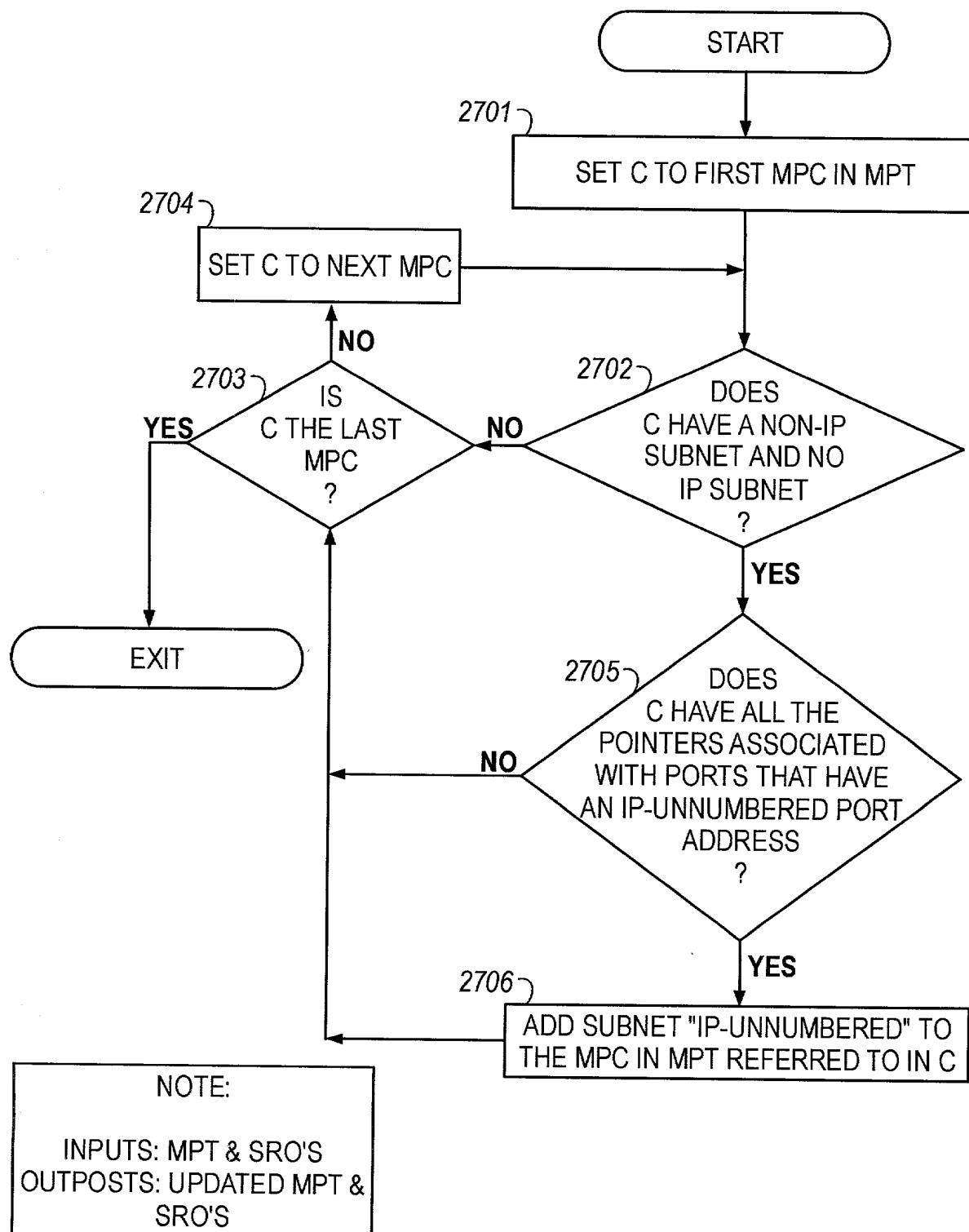


FIG. 27

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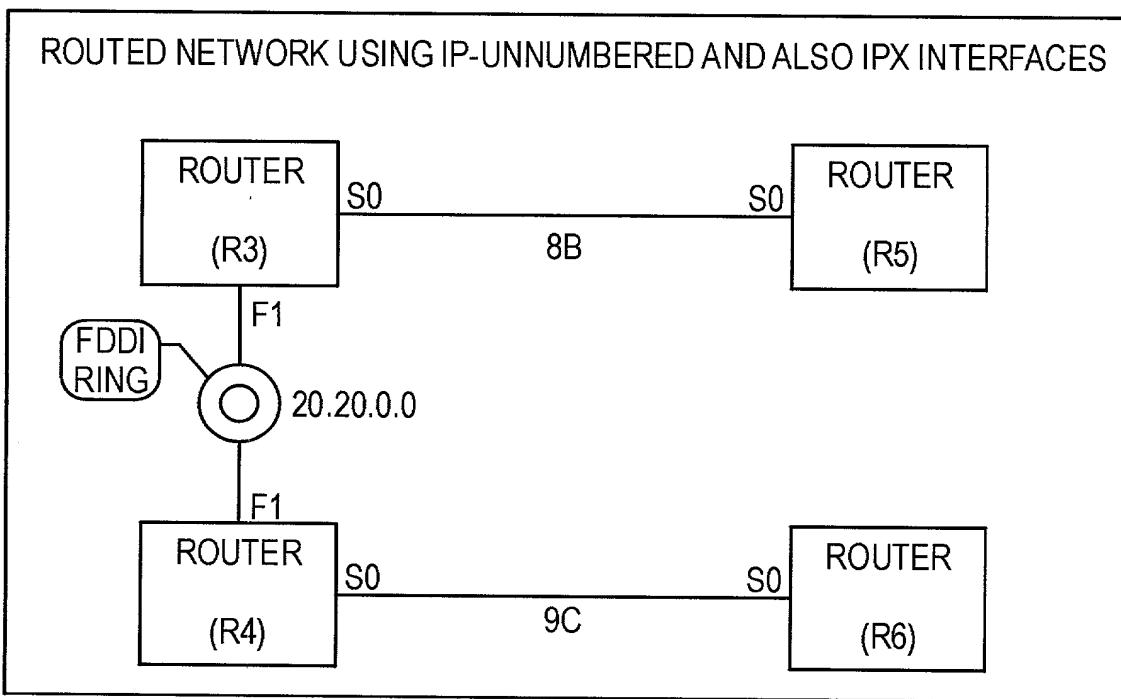


FIG. 28

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ROUTER R3:

2901

```
VERSION 10.0
!
HOSTNAME R3
!
NOVELL ROUTING 0000.0C08.94DD
!
INTERFACE LOOPBACK 1
IP ADDRESS 122.33.2.1 255.255.0.0

INTERFACE SERIAL0
IP-UNNUMBERED LOOPBACK 1
IPX NETWORK 8B
!
INTERFACE FDDI 0
IP ADDRESS 20.20.1.1 255.255.0.0
END
```

ROUTER R4:

```
VERSION 10.0
!
HOSTNAME R4
!
NOVELL ROUTING 0000.0C04.3A3E
!
INTERFACE LOOPBACK 1
IP ADDRESS 127.38.7.6 255.255.0.0

INTERFACE SERIAL0
IP-UNNUMBERED LOOPBACK 1
IPX NETWORK 9C
!
INTERFACE FDDI 0
IP ADDRESS 20.20.0.0 255.255.0.0
END
```

FIG. 29A

FIG. 29B

ROUTER R5:

```
VERSION 10.0
!
HOSTNAME R5
!
NOVELL ROUTING 0000.0D09.A5EE
!
INTERFACE LOOPBACK 1
IP ADDRESS 127.38.7.6 255.255.0.0

INTERFACE SERIAL0
IP-UNNUMBERED LOOPBACK 1
IPX NETWORK 8B
!
END
```

ROUTER R6:

```
VERSION 10.0
!
HOSTNAME R6
!
NOVELL ROUTING 0000.0D05.4B4F
!
INTERFACE LOOPBACK 1
IP ADDRESS 132.43.12.11 255.255.0.0

INTERFACE SERIAL0
IP-UNNUMBERED LOOPBACK 1
IPX NETWORK 9C
!
END
```

FIG. 29C

FIG. 29D

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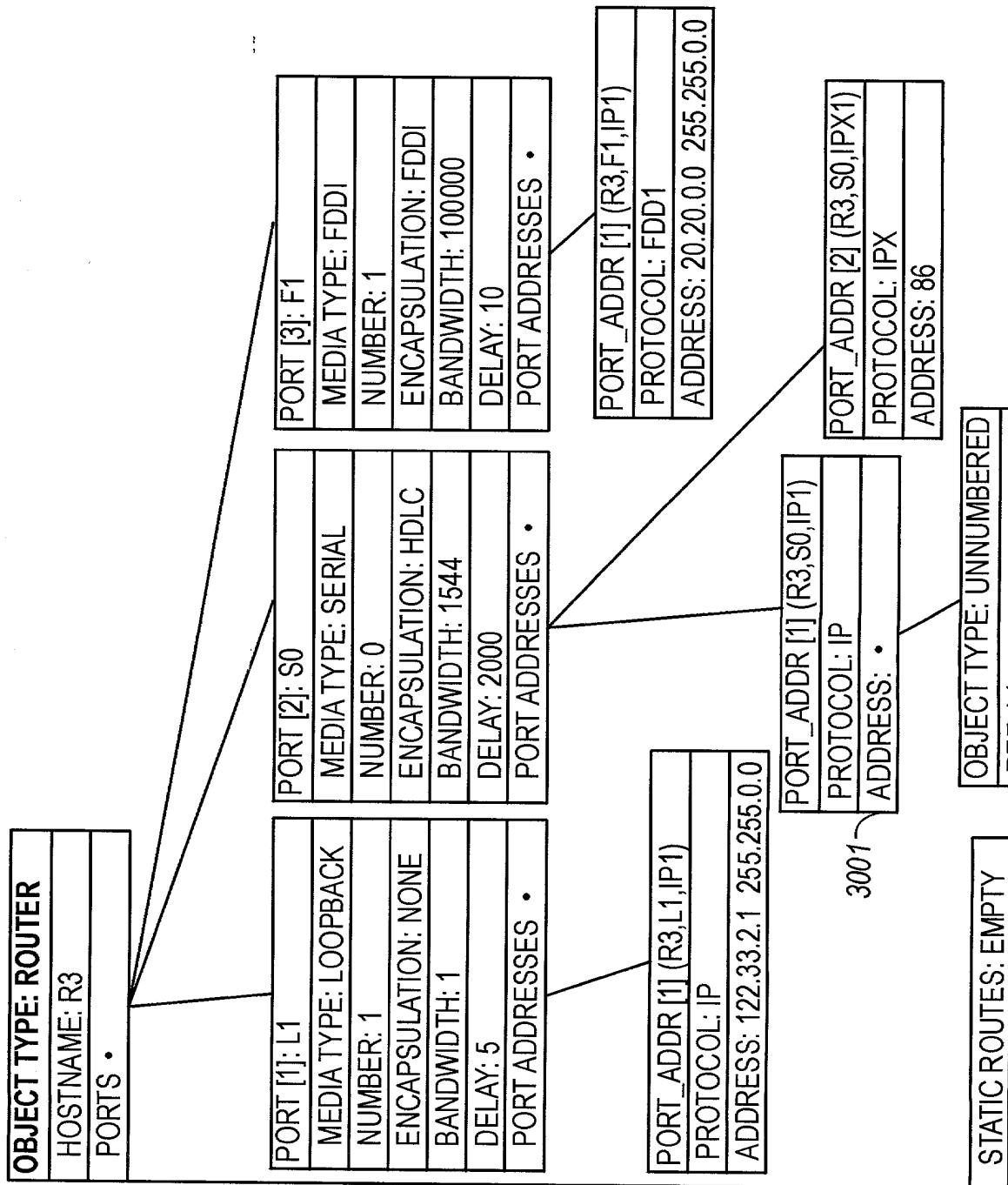


FIG. 30A

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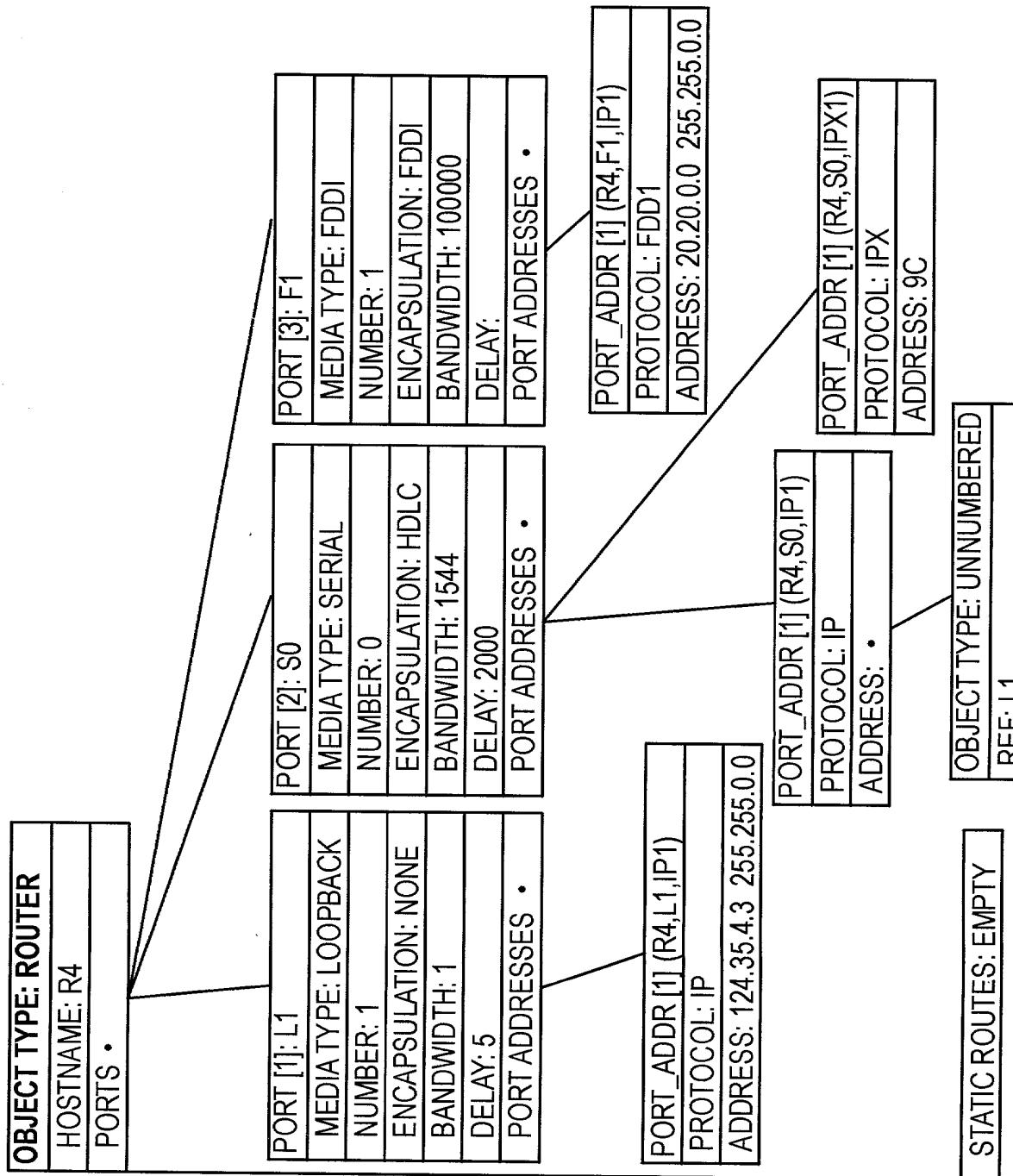


FIG. 30B

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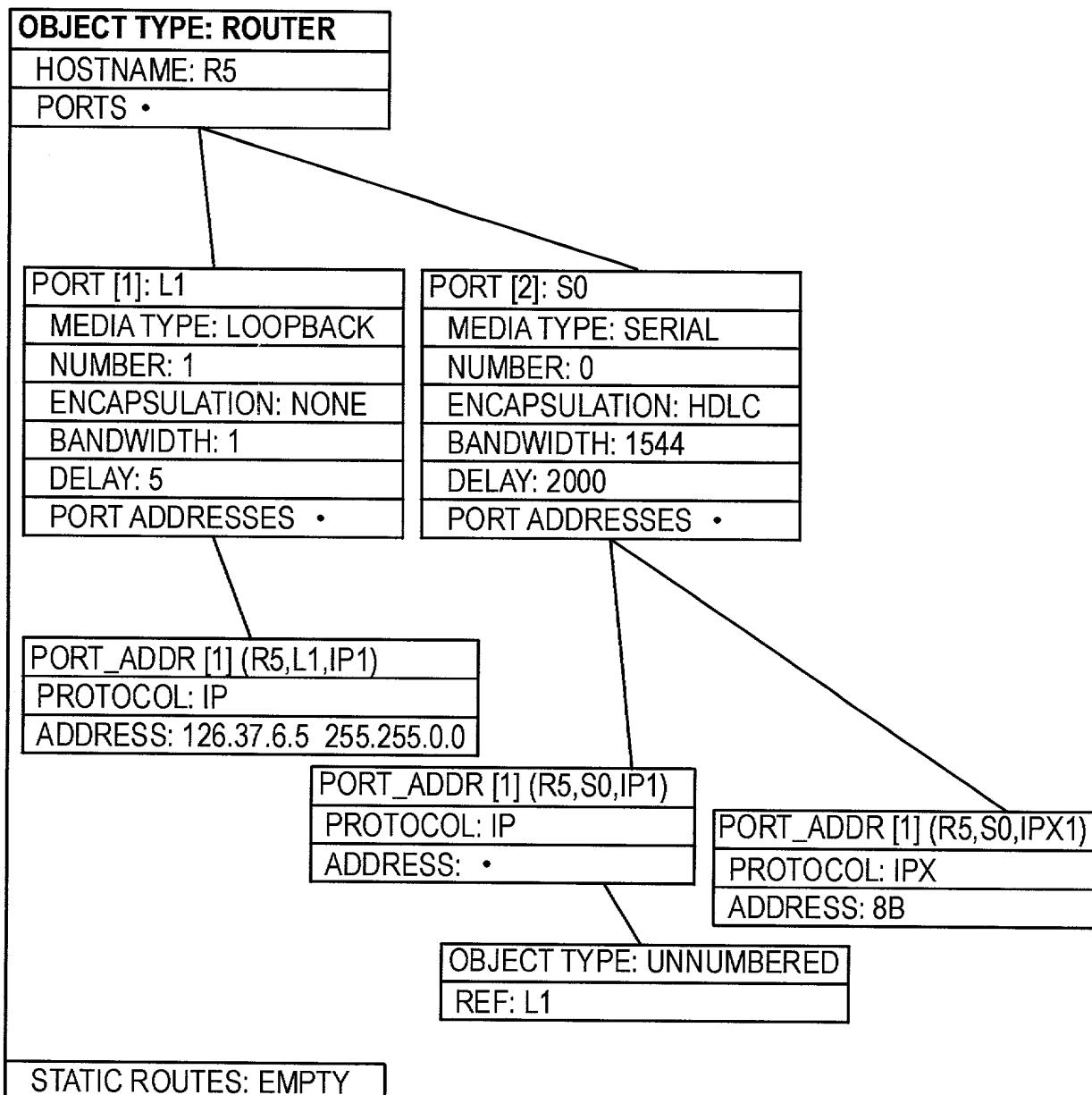


FIG. 30C

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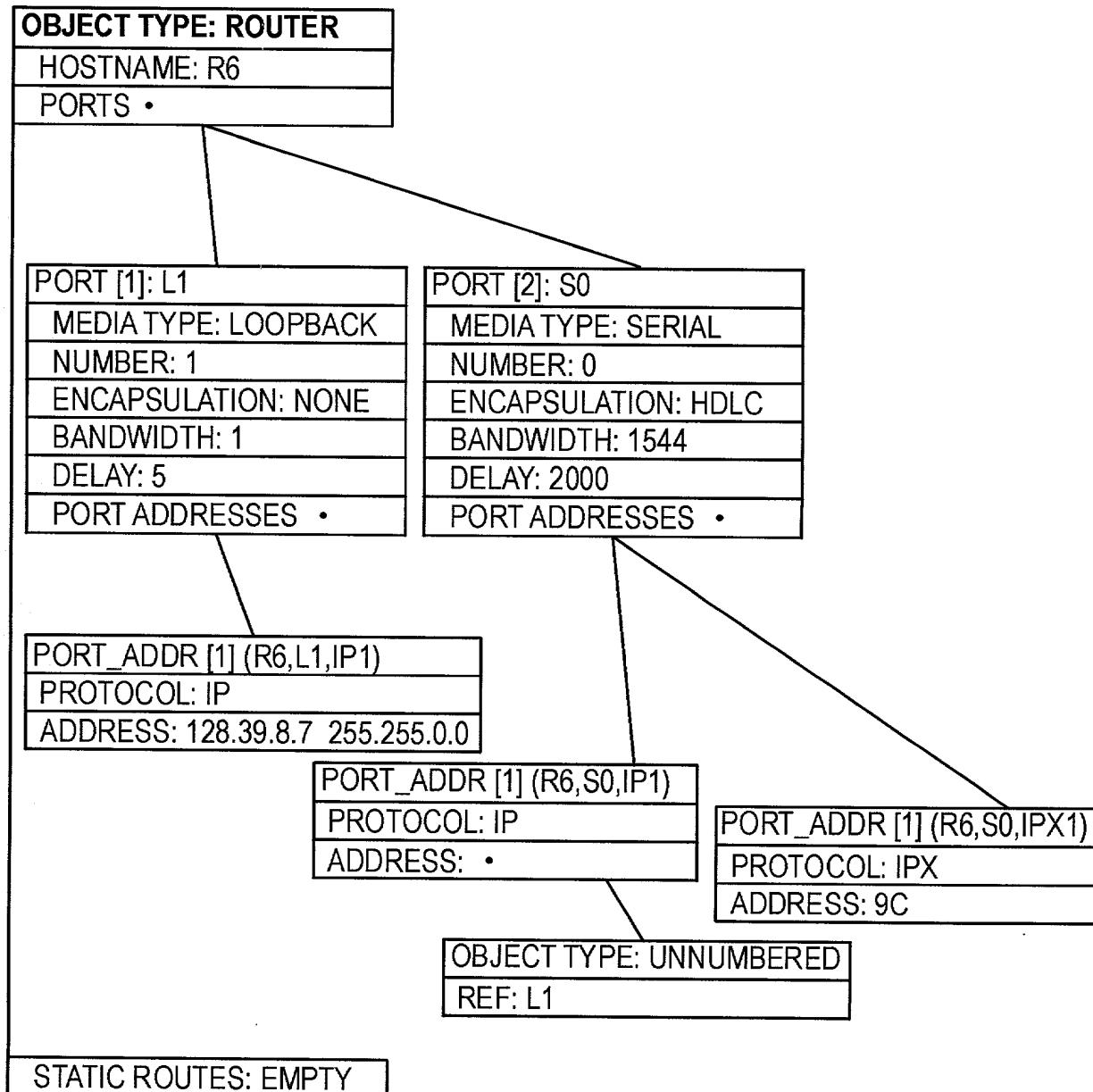


FIG. 30D

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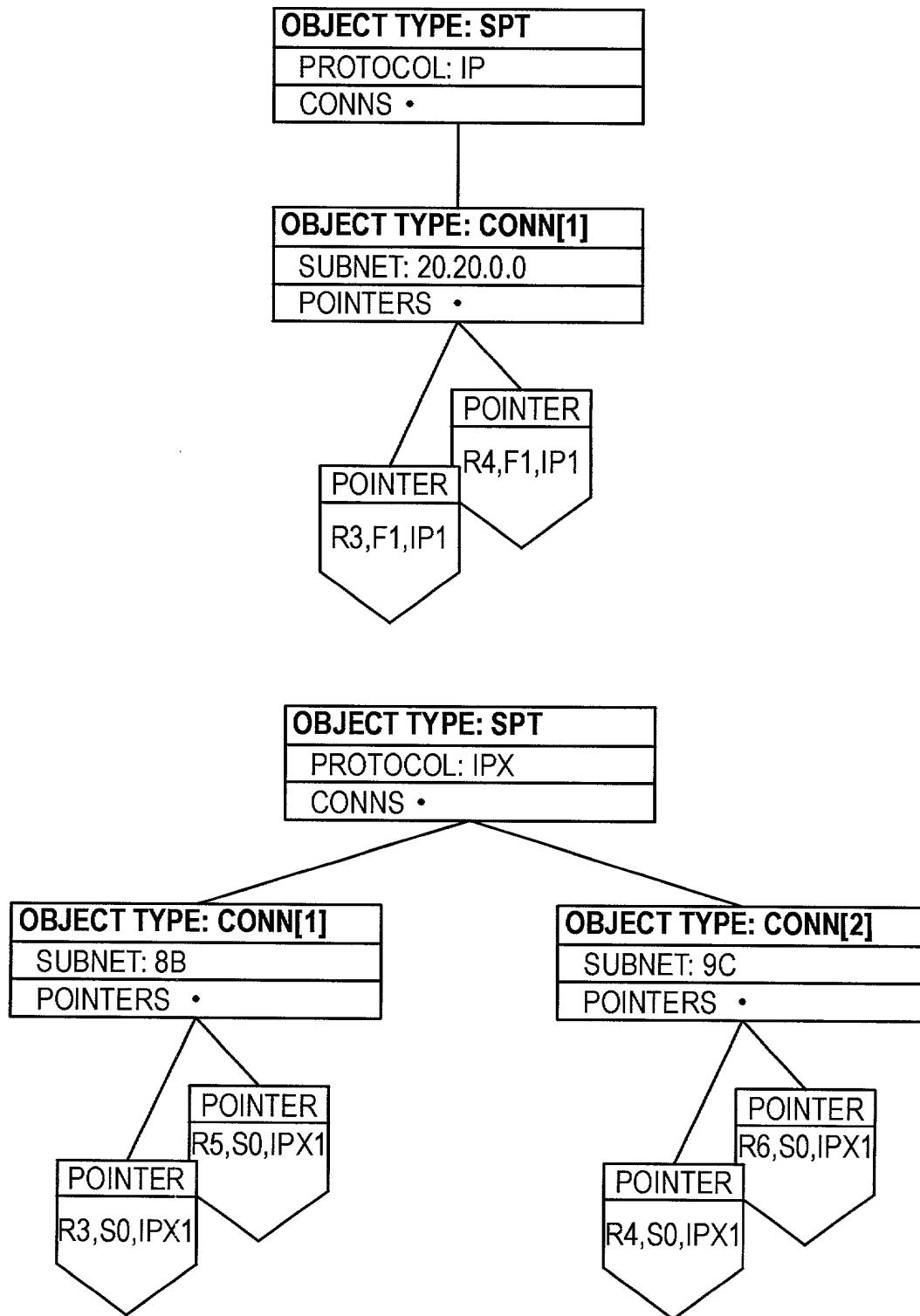


FIG. 30E

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**MPT**

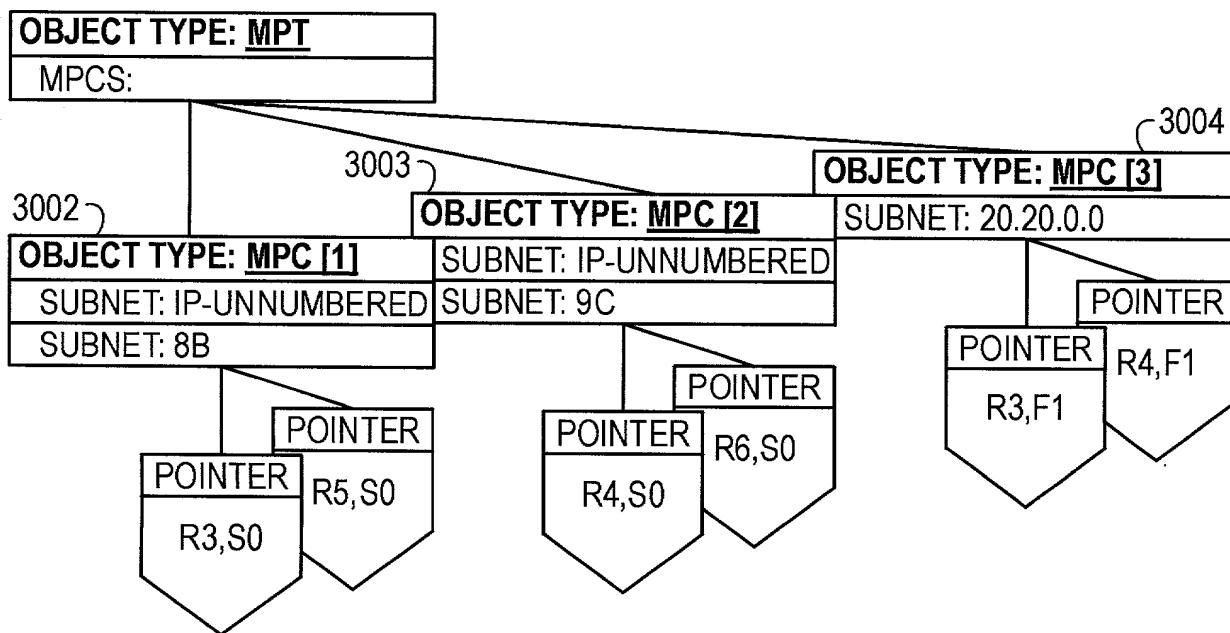


FIG. 30F

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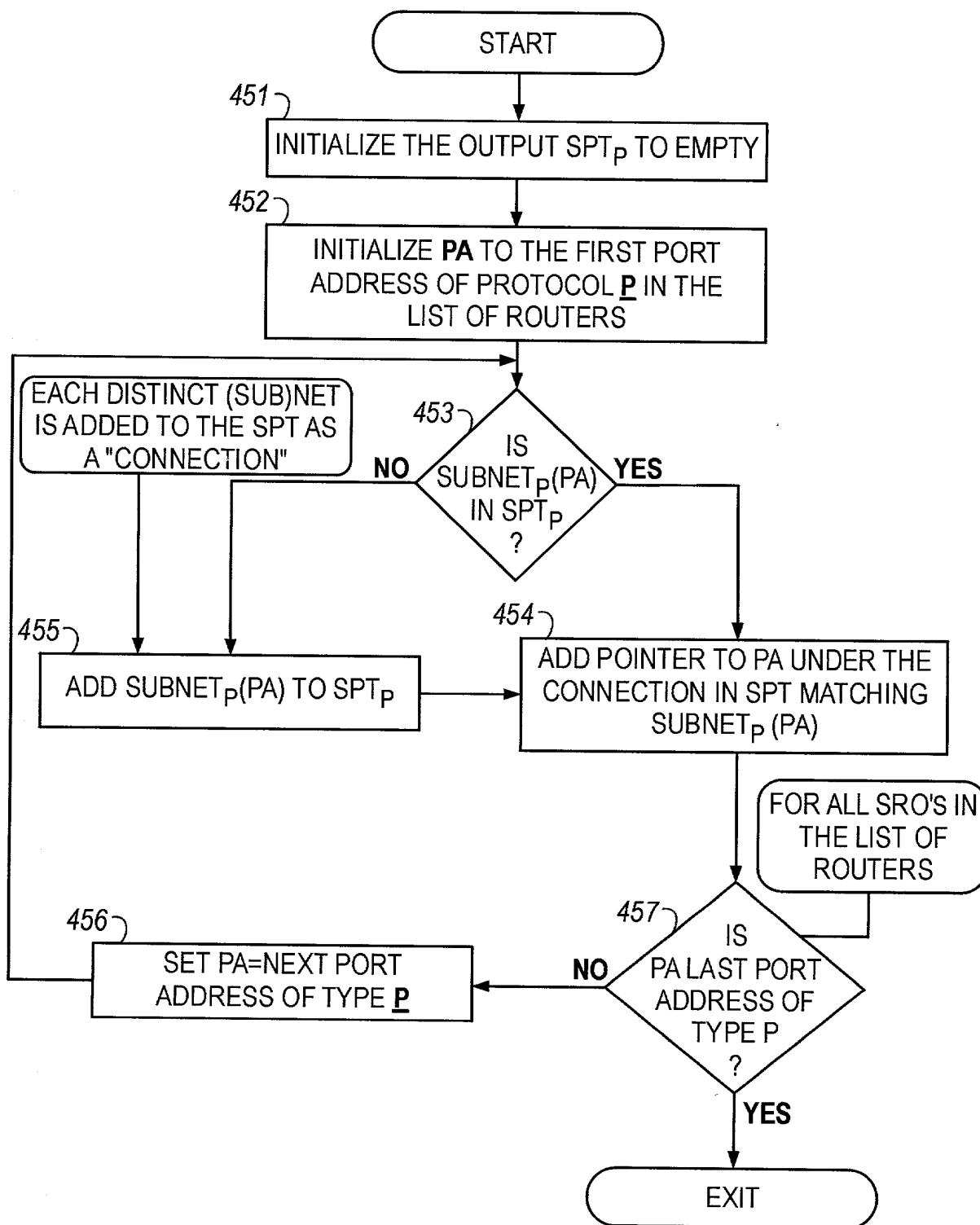


FIG. 31

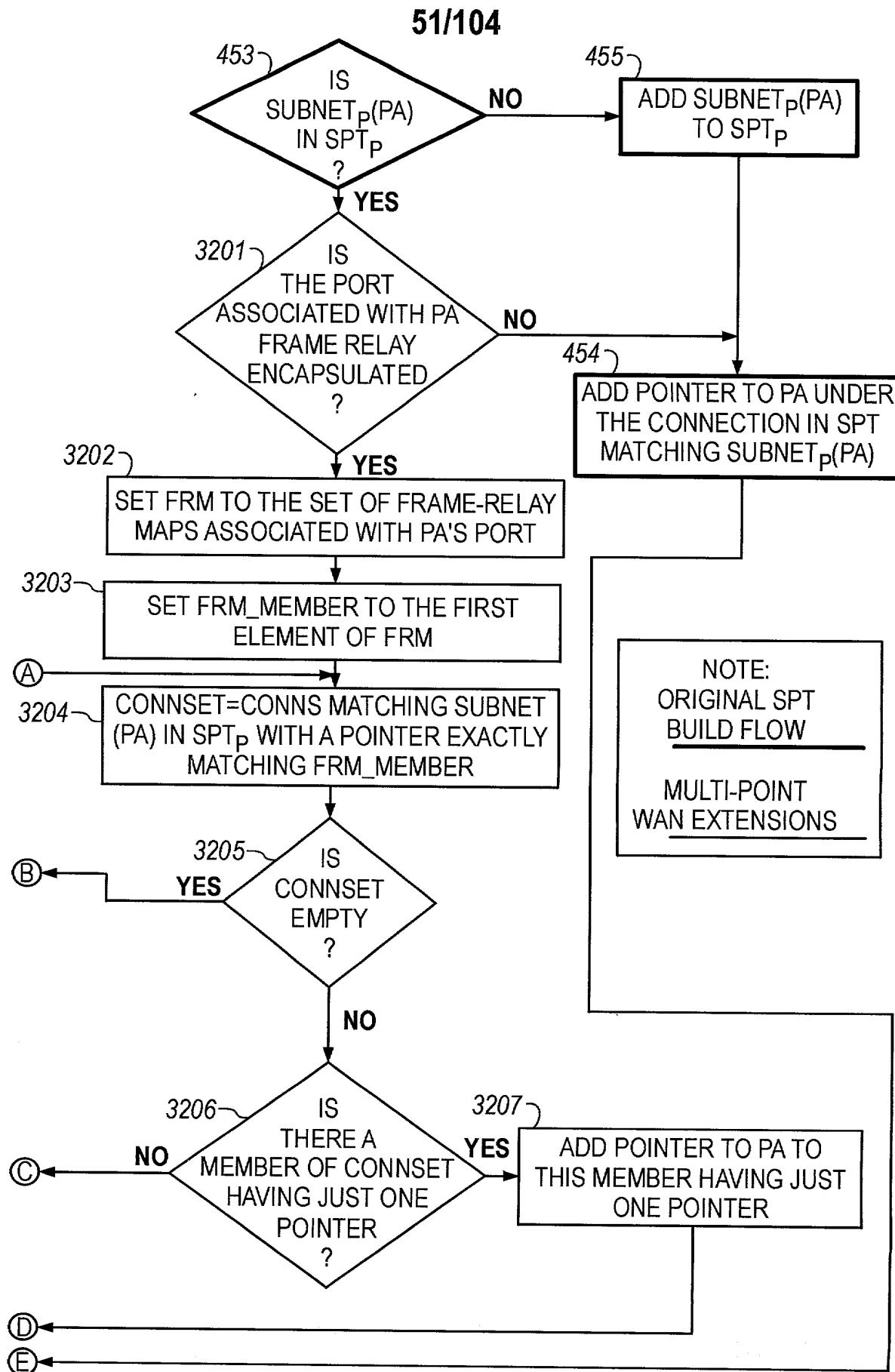


FIG. 32A

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CODE 74905 - FILE 10000000000000000000000000000000

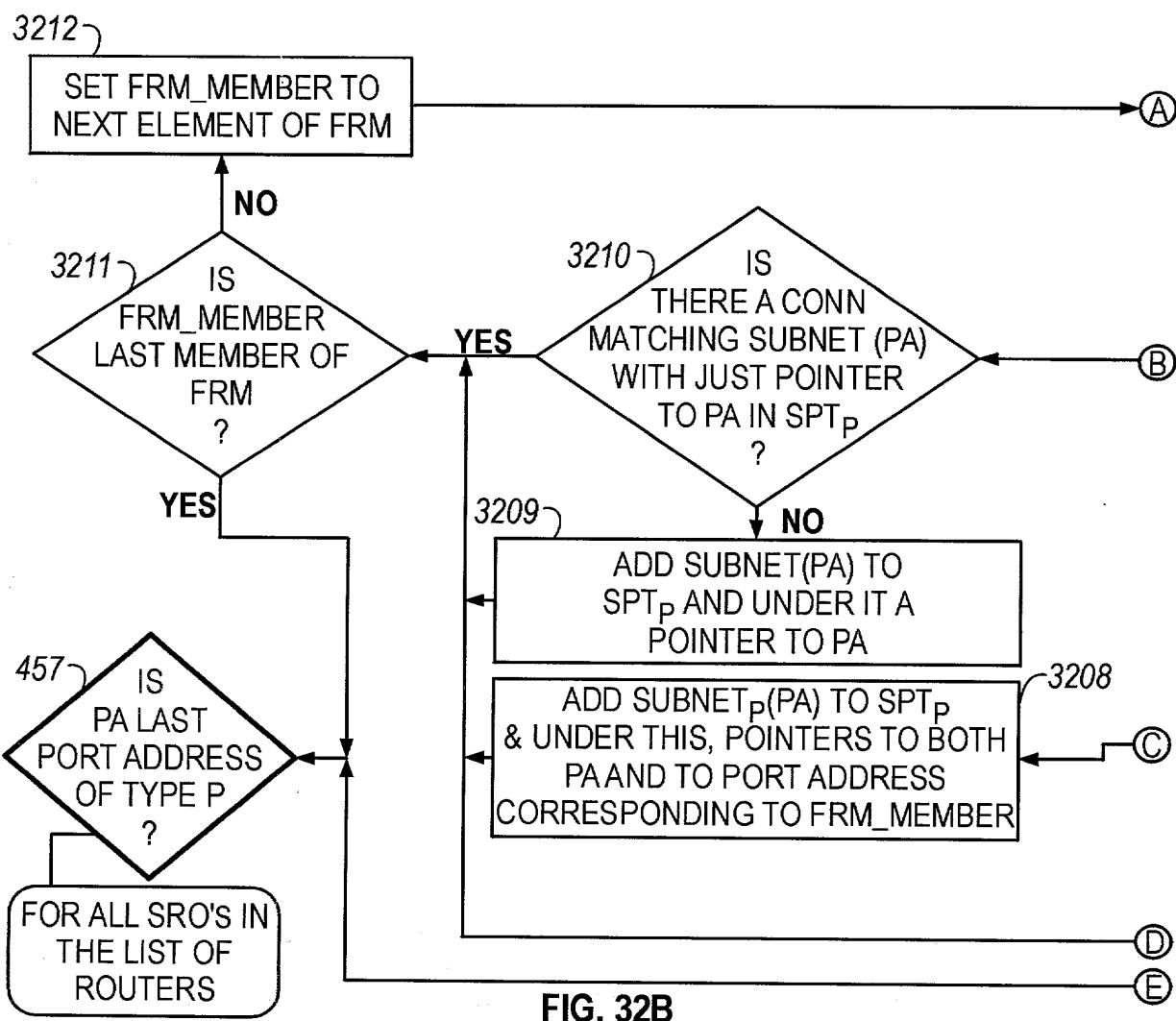


FIG. 32B

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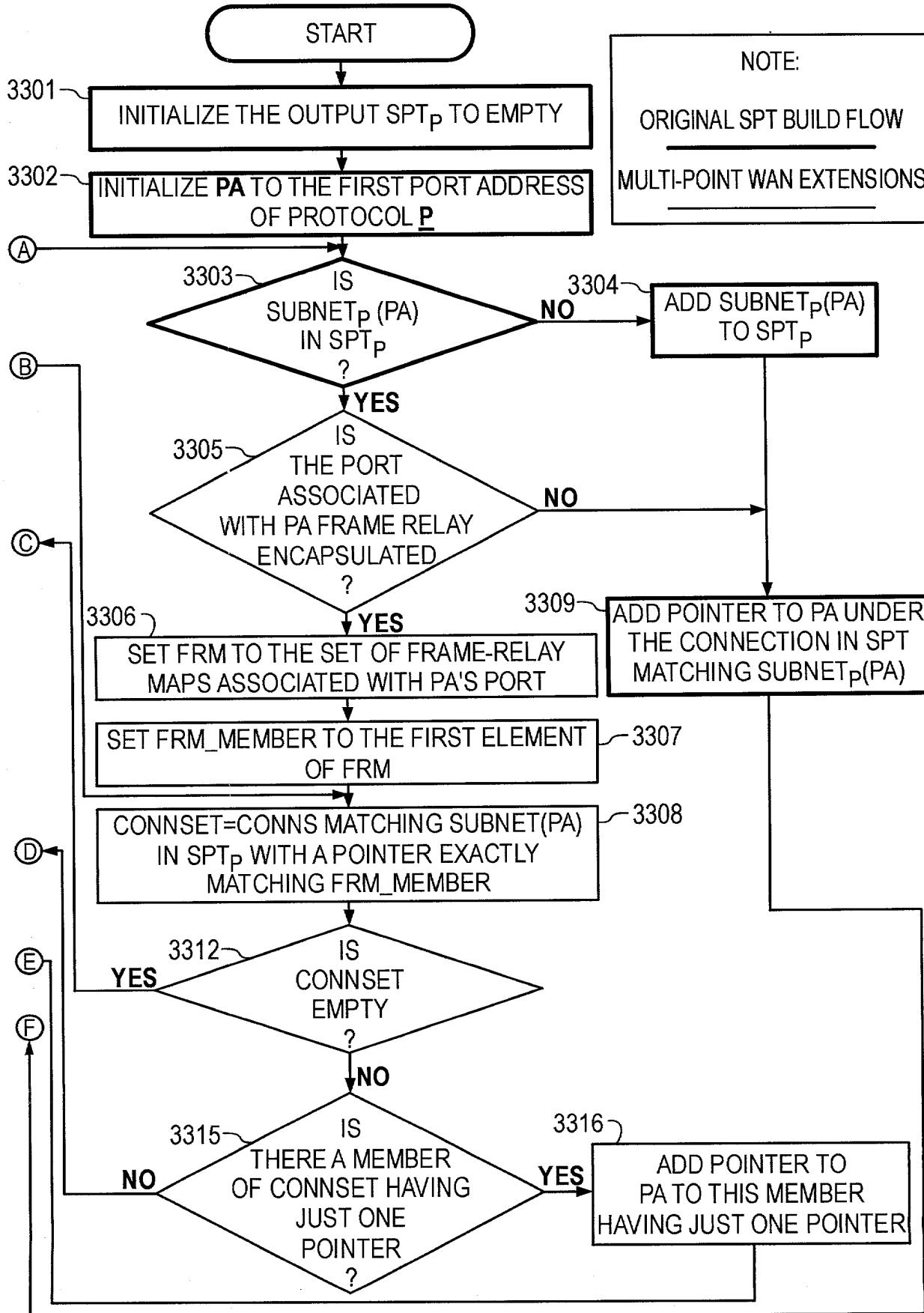


FIG. 33A

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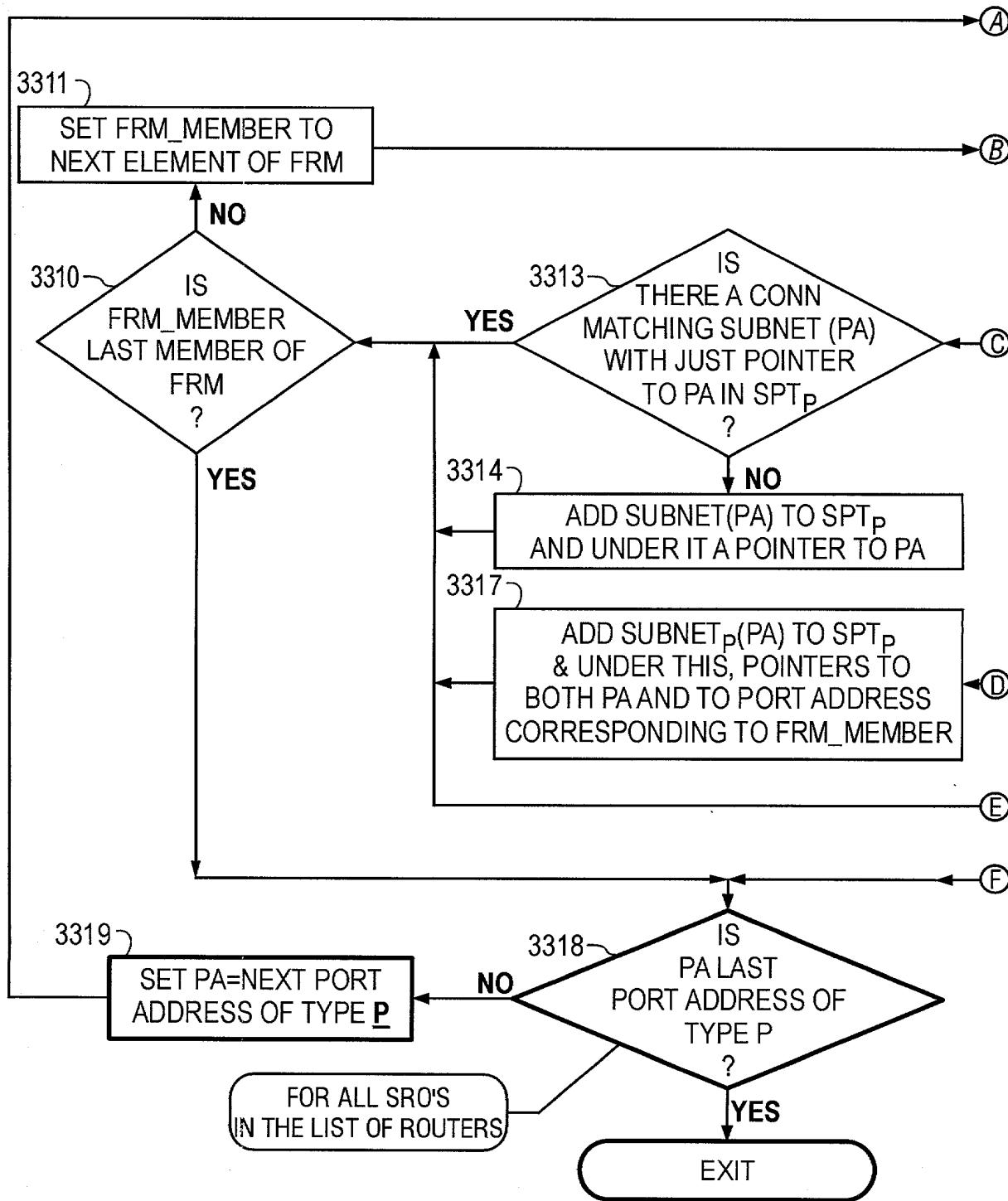
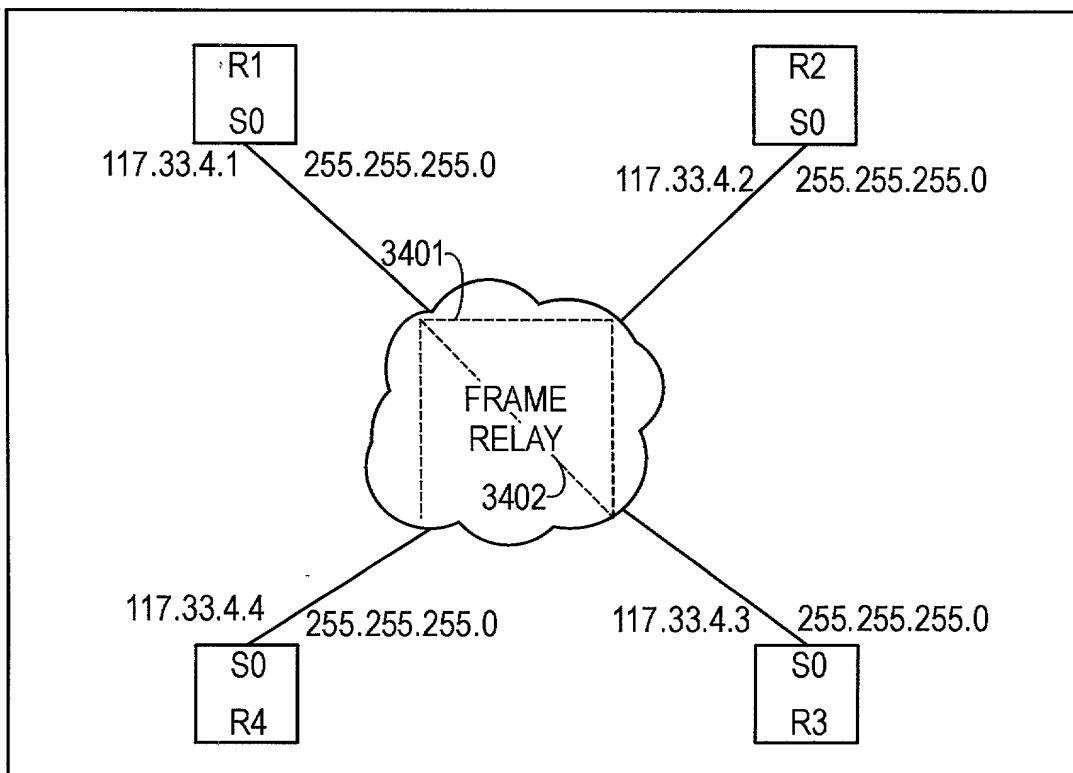


FIG. 33B

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**FIG. 34**

NOTE TO FIGURE 34

THE NOTION OF A FRAME RELAY CLOUD IMPLIES FULLY MESHED CONNECTIVITY, YET IN ACTUALITY CONNECTIVITY MAY BE LIMITED AS SHOWN WITH DOTTED LINES INSIDE CLOUD

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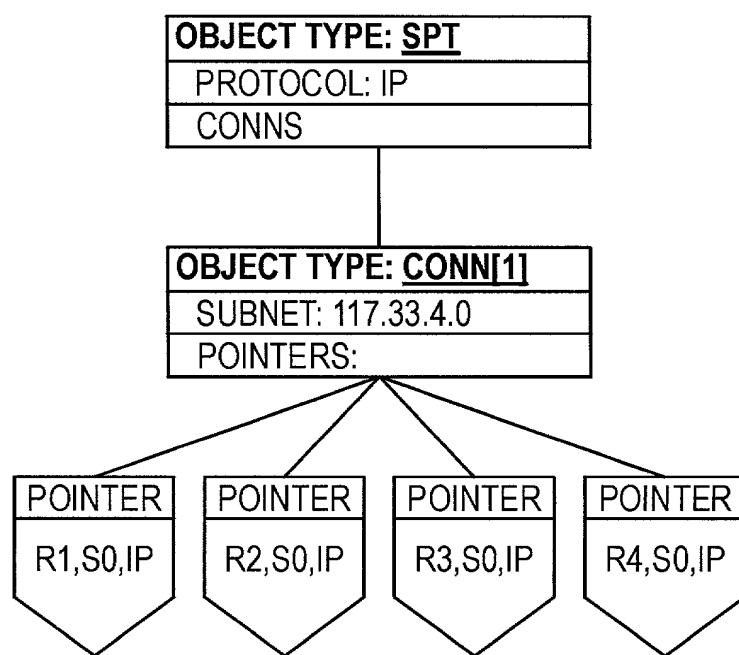


FIG. 35

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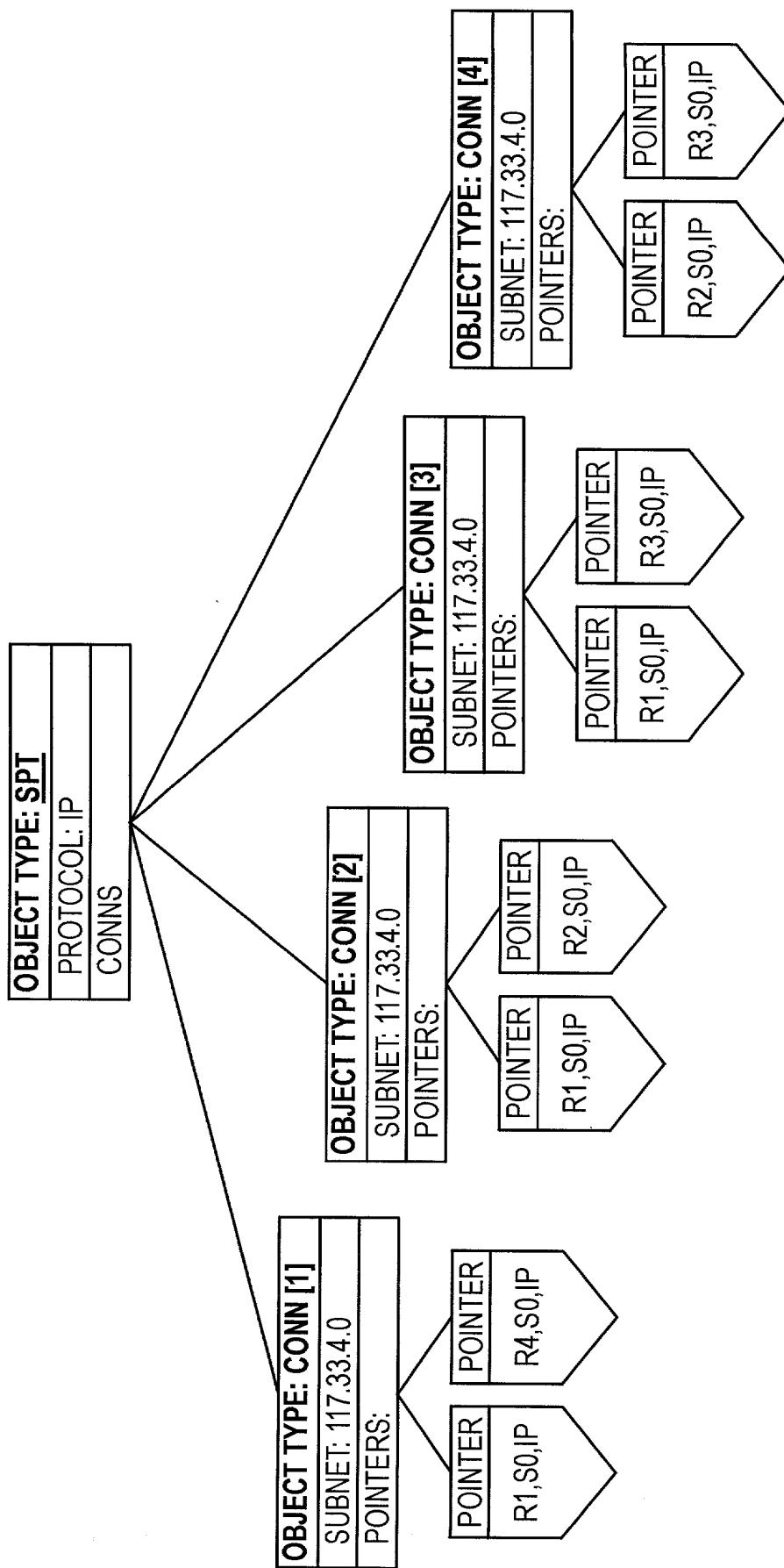


FIG. 36

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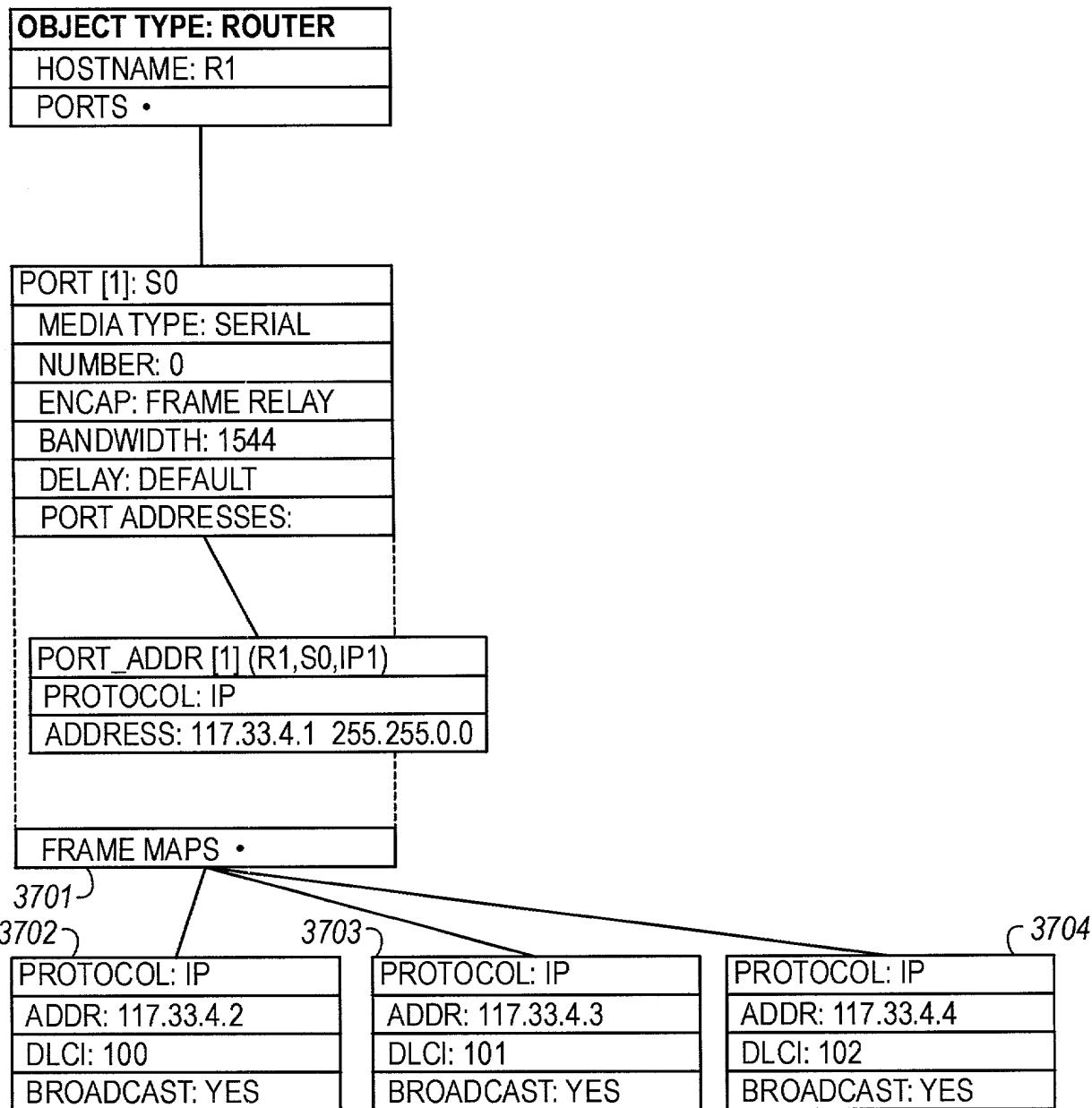


FIG. 37

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3801

```
VERSION 10.0
!
HOSTNAME R1
!
IP SUBNET-ZERO
!
INTERFACE SERIAL0
DESCRIPTION SERIAL 0
ENCAPSULATION FRAME-RELAY
IP ADDRESS 117.33.4.1 255.255.0.0
FRAME RELAY MAP IP 117.33.4.2 100 BROADCAST
FRAME RELAY MAP IP 117.33.4.3 101 BROADCAST
FRAME RELAY MAP IP 117.33.4.4 102 BROADCAST
!
ROUTER RIP 109
NETWORK 117.33.0.0
END
```

**FIG. 38A**

3803

```
VERSION 10.0
!
HOSTNAME R2
!
IP SUBNET-ZERO
!
INTERFACE SERIAL0
DESCRIPTION SERIAL 0
ENCAPSULATION FRAME-RELAY
IP ADDRESS 117.33.4.1 255.255.0.0
FRAME RELAY MAP IP 117.33.4.1 100 BROADCAST
FRAME RELAY MAP IP 117.33.4.3 101 BROADCAST
!
ROUTER RIP 109
NETWORK 117.33.0.0
END
```

**FIG. 38B**

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```
VERSION 10.0
!
HOSTNAME R3
!
IP SUBNET-ZERO
!
INTERFACE SERIAL0
DESCRIPTION SERIAL 0
ENCAPSULATION FRAME-RELAY
IP ADDRESS 117.33.4.1 255.255.0.0
FRAME RELAY MAP IP 117.33.4.1 100 BROADCAST
FRAME RELAY MAP IP 117.33.4.2 101 BROADCAST
!
ROUTER RIP 109
NETWORK 117.33.0.0
END
```

FIG. 38C

```
VERSION 10.0
!
HOSTNAME R4
!
IP SUBNET-ZERO
!
INTERFACE SERIAL0
DESCRIPTION SERIAL 0
ENCAPSULATION FRAME-RELAY
IP ADDRESS 117.33.4.1 255.255.0.0
FRAME RELAY MAP IP 117.33.4.1 100 BROADCAST
!
ROUTER RIP 109
NETWORK 117.33.0.0
END
```

FIG. 38D

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3901

OBJECT TYPE: <u>SPT</u>
PROTOCOL: IP
CONNs: [EMPTY]

3301

INITIALIZED SPT SET  
TO EMPTY

3902

PA = 117.33.4.1 255.255.255.0

3903

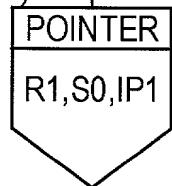
NO - SUBNET<sub>P</sub>(PA) NOT IN SPT<sub>P</sub>

3904

OBJECT TYPE: <u>SPT</u>
PROTOCOL: IP
CONNs:

OBJECT TYPE: <u>CONN[1]</u>
SUBNET: 117.33.4.0
POINTERS:

3909



3918

NO - PA NOT LAST PORT ADDRESS

3919

PA = 117.33.4.2 255.255.255.0

3903-1

YES: 117.33.4.1 BELONGS TO SUBNET 117.33.4.0

FIG. 39A

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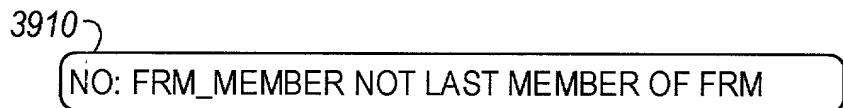
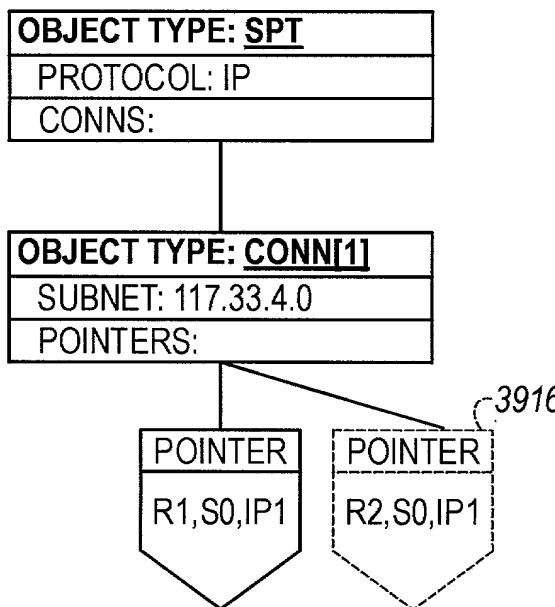
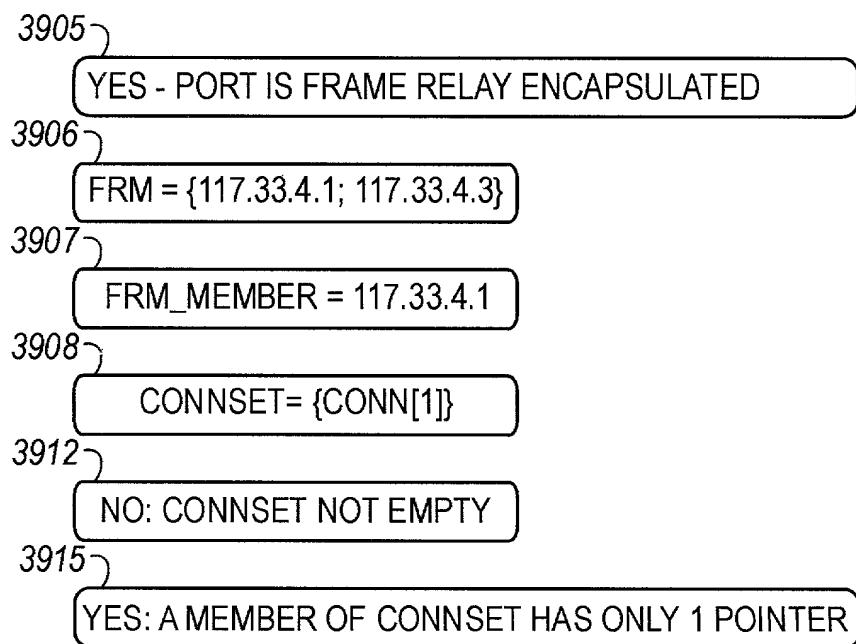


FIG. 39B

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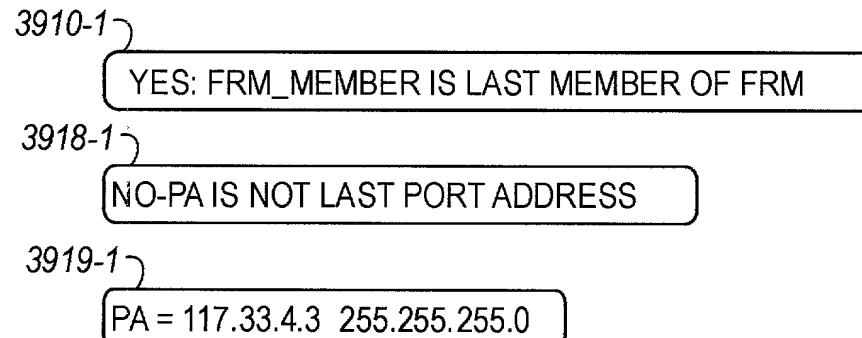
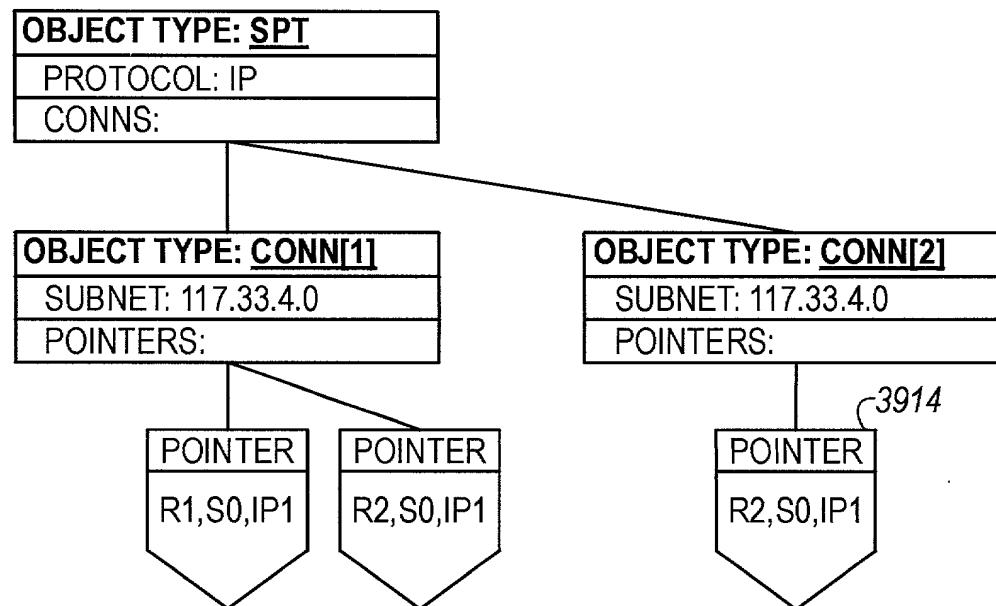
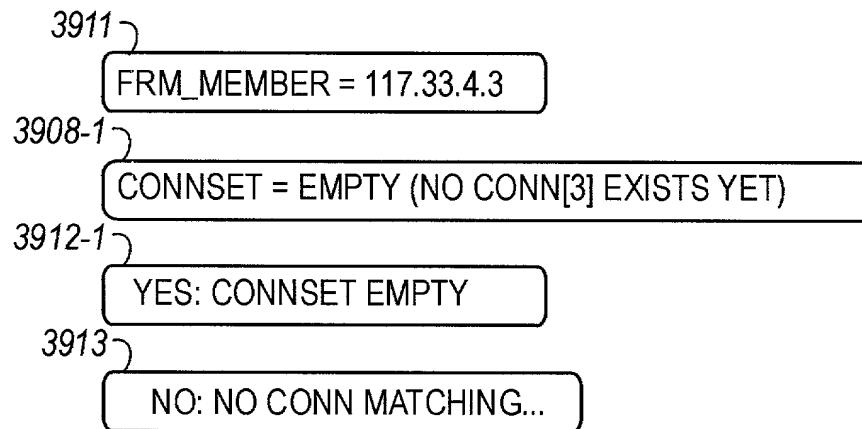


FIG. 39C

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3903-1 YES - [117.33.4.0 255.255.255.0]  
3905-1 YES - THE PORT IS FRAME RELAY ENCAPSULATED  
3906-1 FRM = {117.33.4.1; 117.33.4.2}  
3907-1 FRM\_MEMBER = 117.33.4.1 (R1,S0, IP1)  
3908-1 CONNSET = {CONN[1]}  
3912-1 NO: CONNSET NOT EMPTY  
3915-1 NO: NO MBR OF CONNSET HAS ONLY 1 POINTER

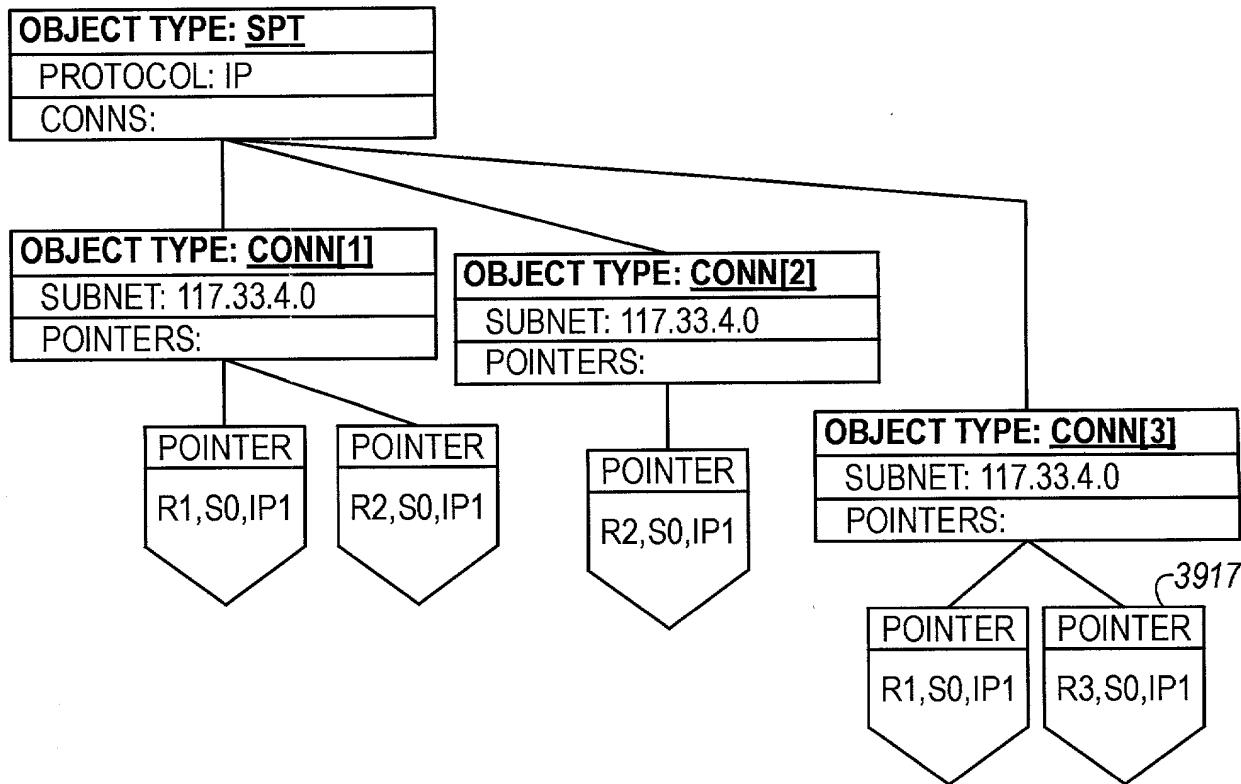


FIG. 39D

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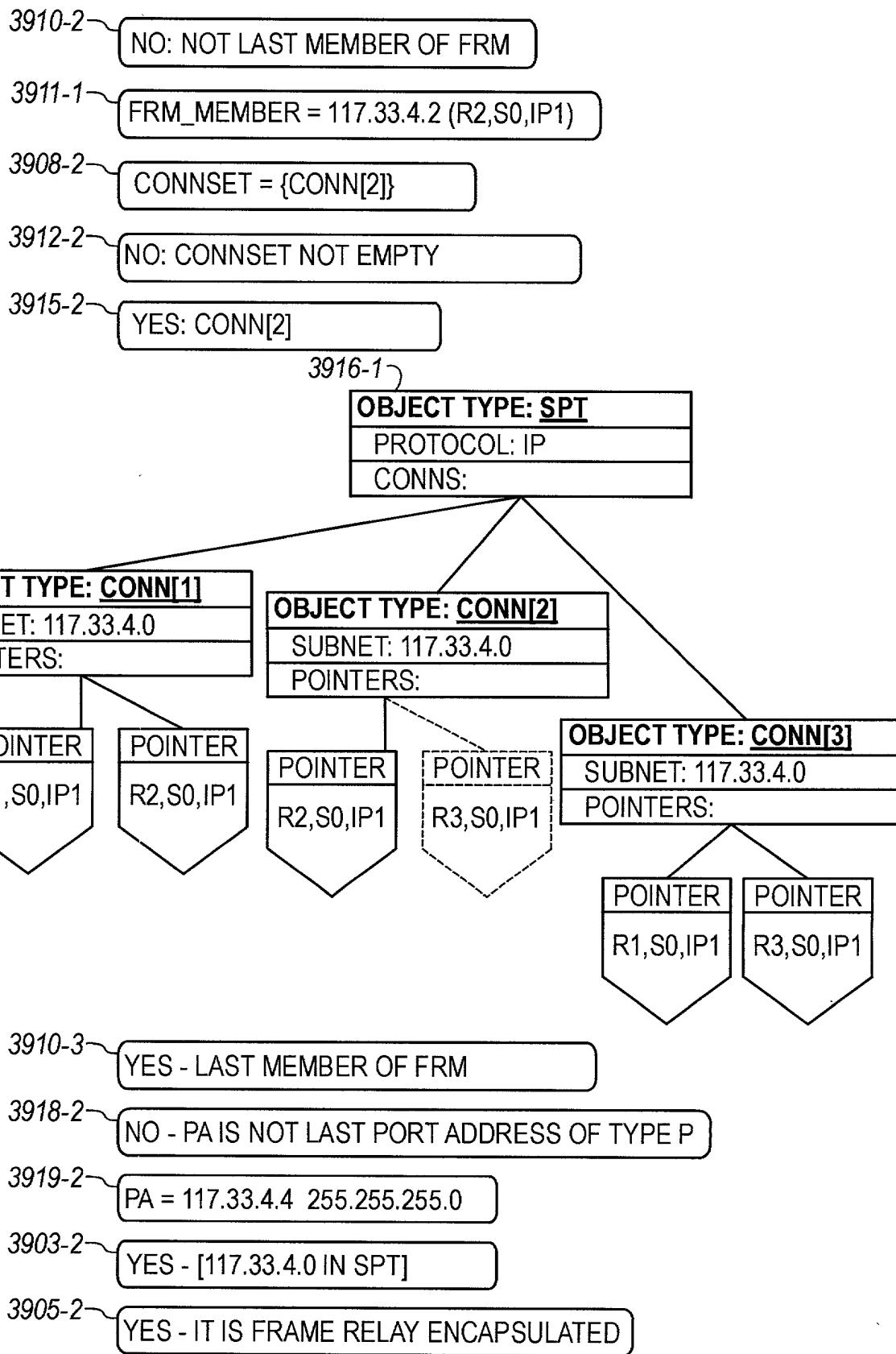


FIG. 39E

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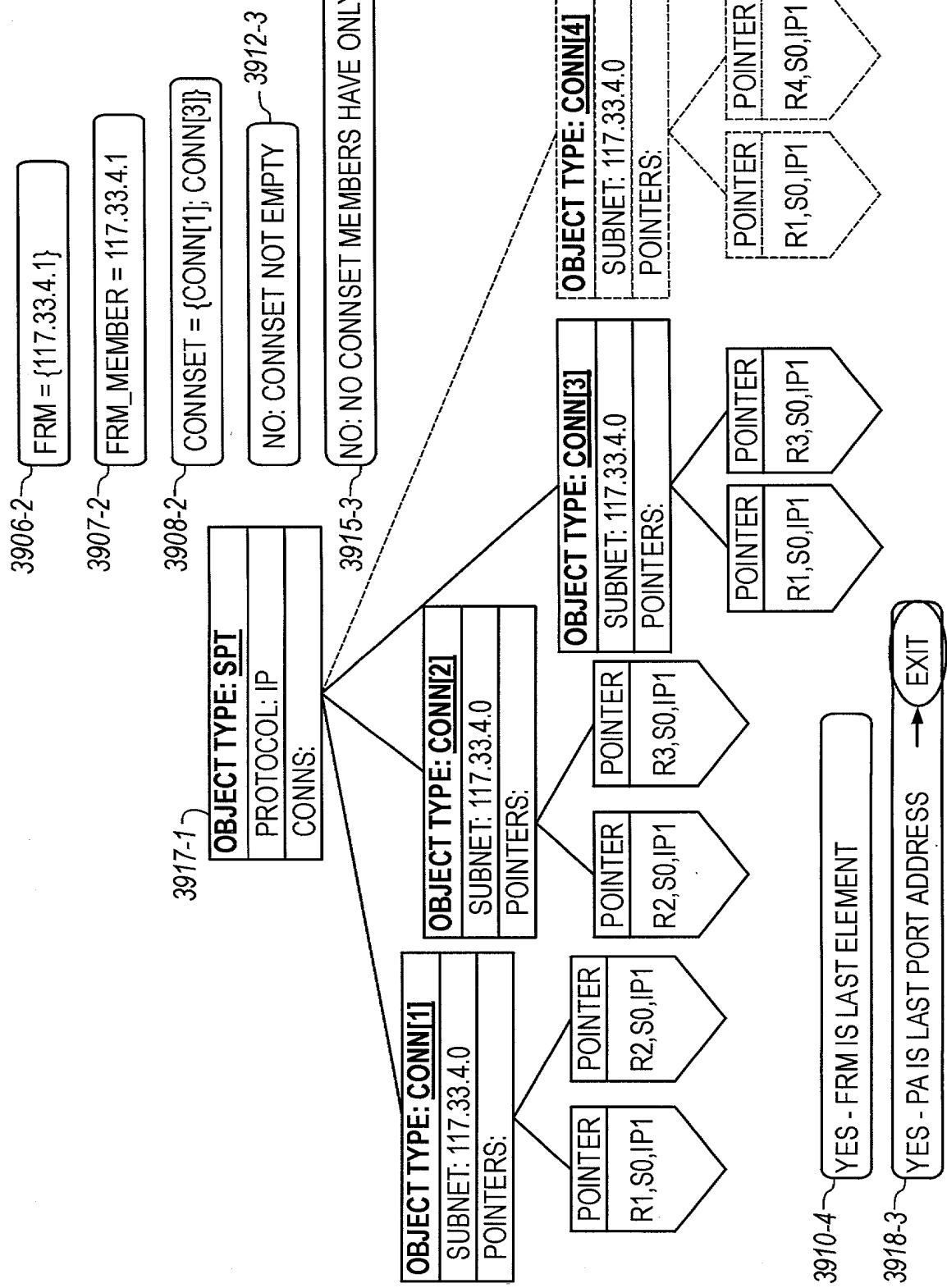


FIG. 39E

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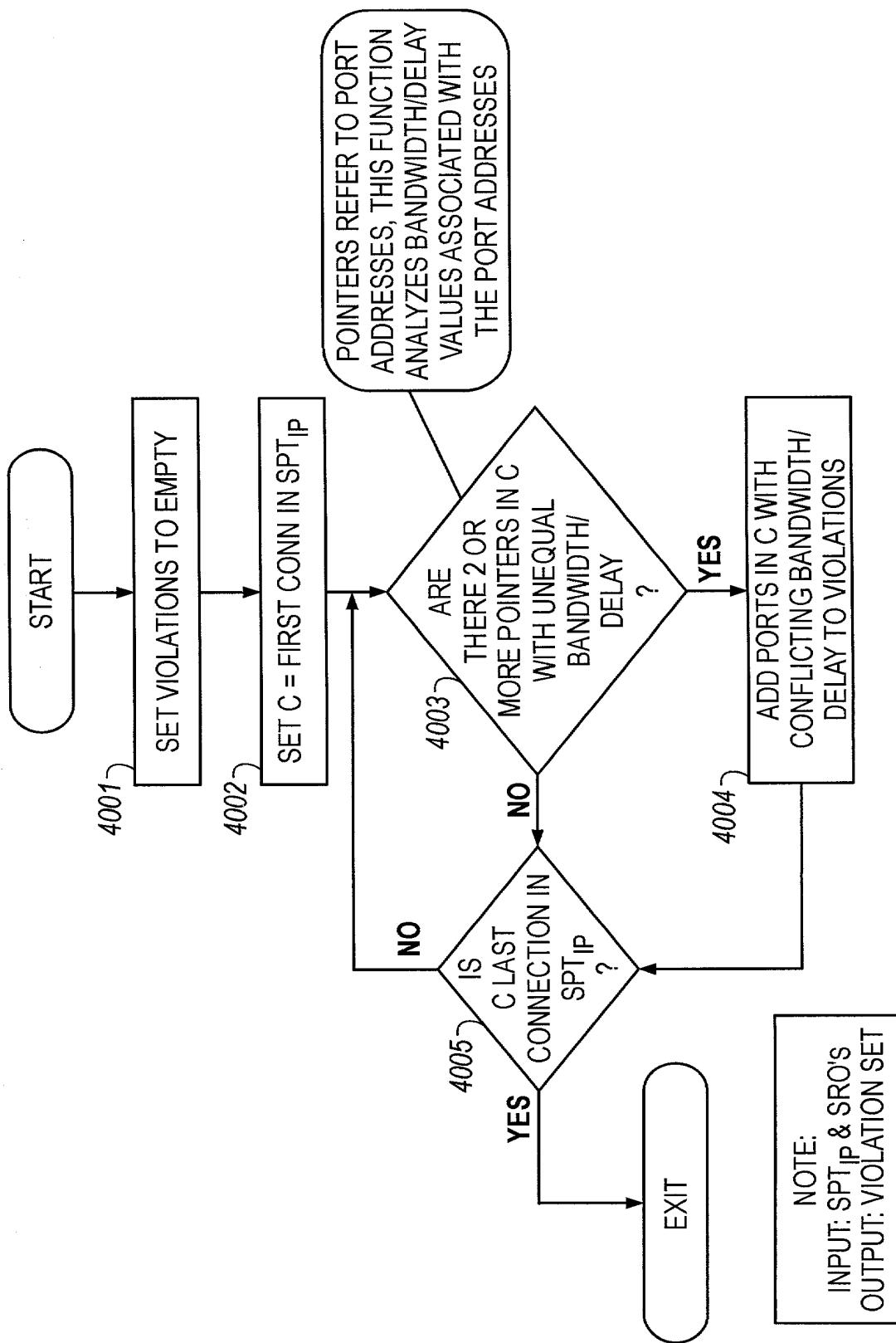


FIG. 40

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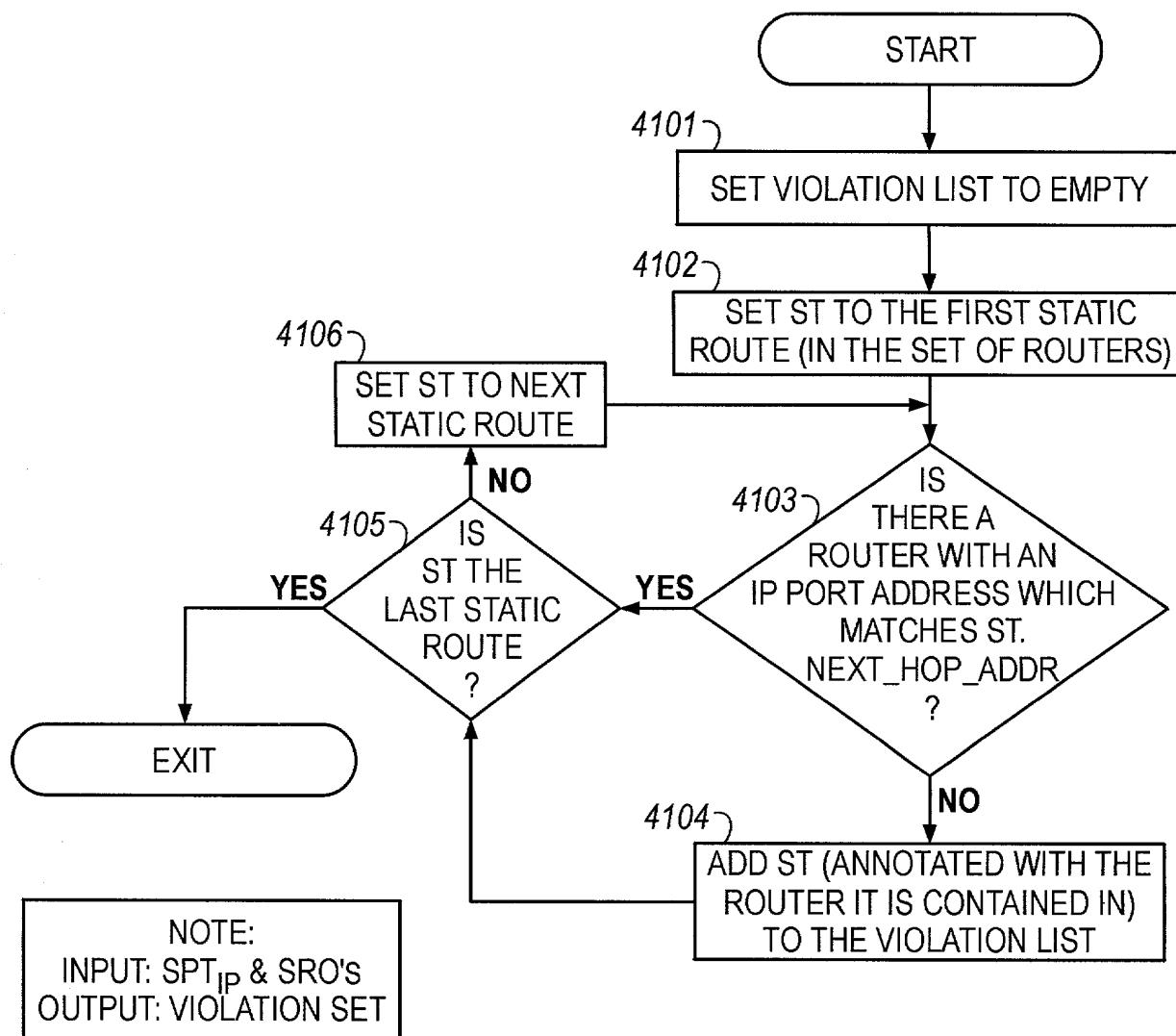
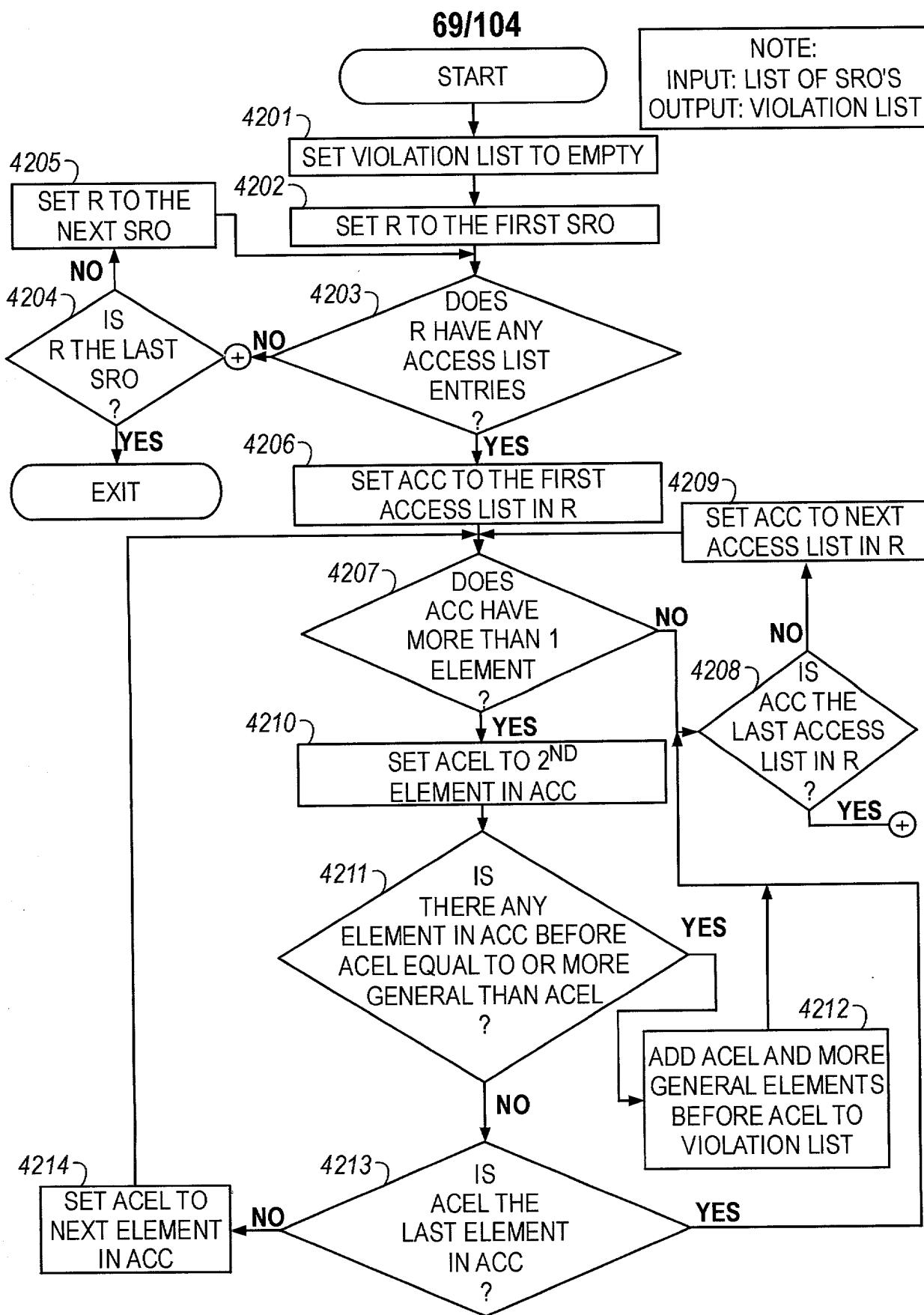


FIG. 41



**FIG. 42**

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INPUTS:  $SPT_p$  AND THE SRO'S IT POINTS TO, AND THE OPERATIONAL STATUS FOR EACH ROUTER, ROUTER PORT AND CONNECTION  
OUTPUTS: ROUTING TABLES FOR  $PROTOCOL_p$  FOR EACH ROUTER

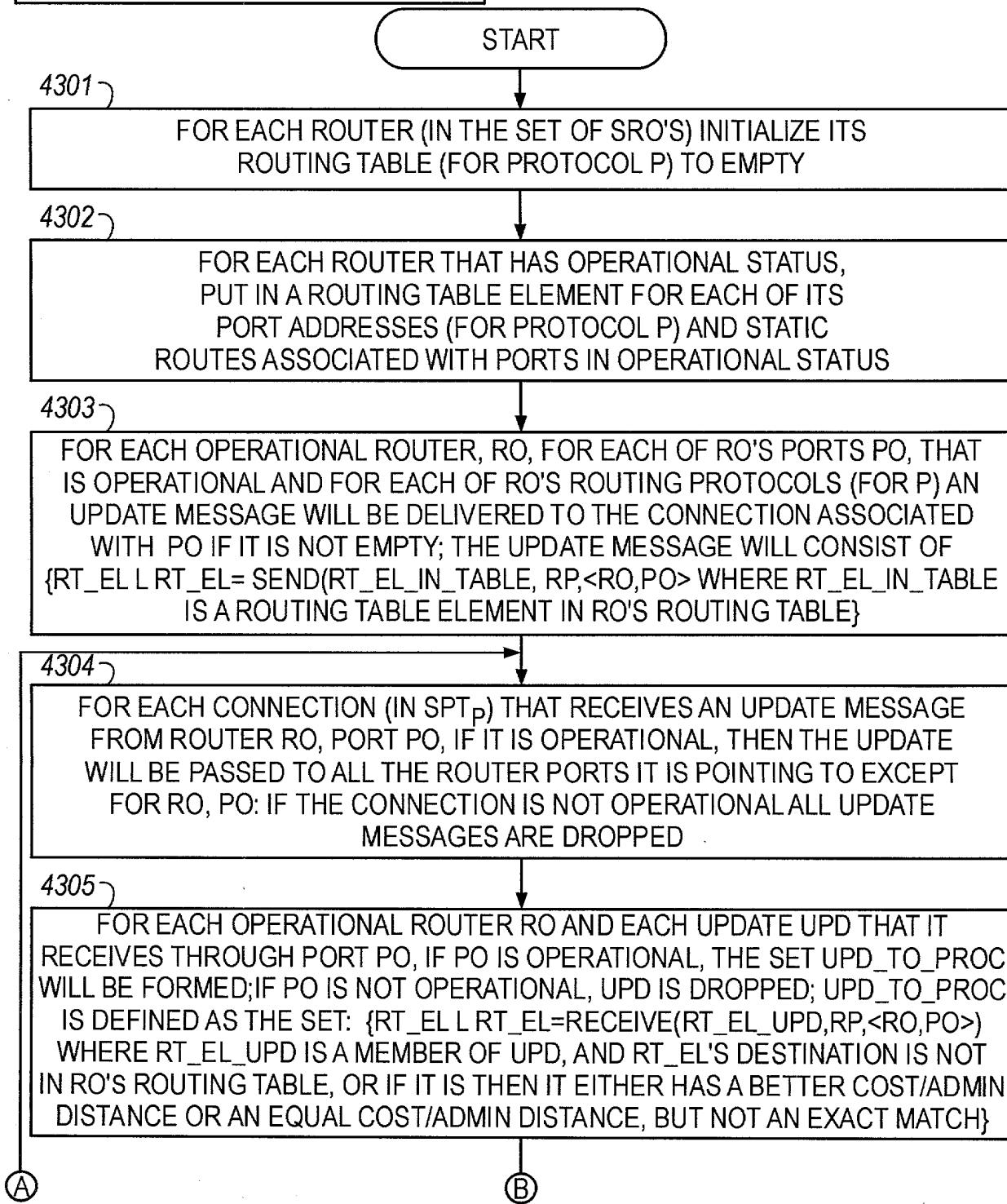


FIG. 43A

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2009-09-22 10:21:22

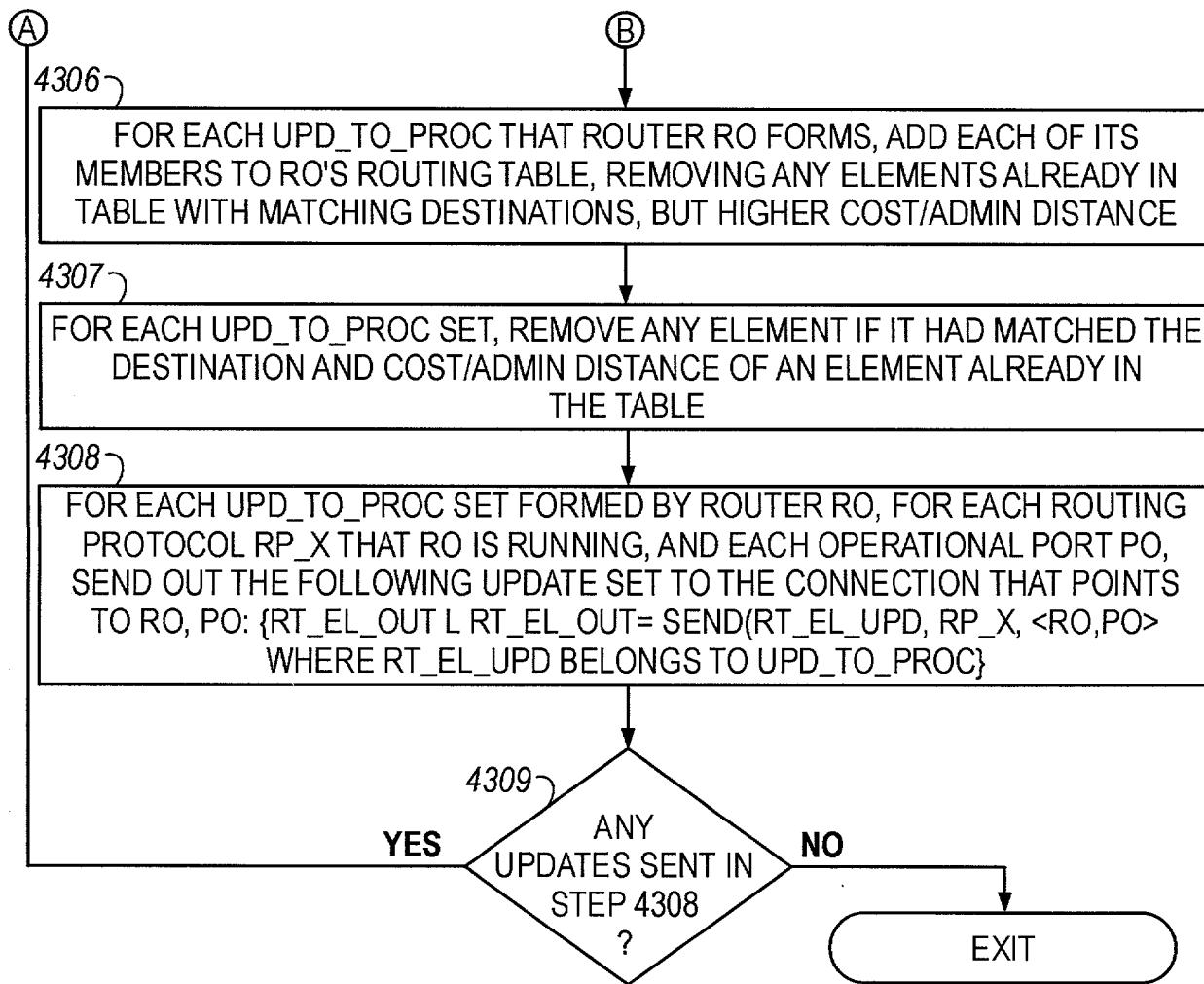


FIG. 43B

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4303

FOR EACH OPERATIONAL ROUTER, RO, FOR EACH OF RO'S PORTS PO, THAT IS OPERATIONAL AND FOR EACH OF RO'S ROUTING PROTOCOLS (FOR P) AN UPDATE MESSAGE WILL BE DELIVERED TO THE CONNECTION ASSOCIATED WITH PO IF IT IS NOT EMPTY; THE UPDATE MESSAGE WILL CONSIST OF {RT\_EL\_L RT\_EL = SEND(RT\_EL\_IN\_TABLE, RP, <RO, PO> WHERE RT\_EL\_IN\_TABLE IS A ROUTING TABLE ELEMENT IN RO'S ROUTING TABLE)}

ADD TO EACH UPDATE MESSAGE A TAG OF THE ROUTER JUST VISITED

4320

4304

4305

4306

4307

4308

4309  
YES  
ANY UPDATES SENT IN STEP 4308 ?

FIG. 43C

4307

FOR EACH UPD\_TO\_PROC SET, REMOVE ANY ELEMENT IF IT HAD MATCHED THE DESTINATION AND COST/ADMIN DISTANCE OF AN ELEMENT ALREADY IN THE TABLE

4330

FOR EACH ROUTER RO, REMOVE ANY UPD\_TO\_PROC SET THAT WAS FORMED FROM AN UPDATE HAVING A TAG MATCHING RO

4308

FOR EACH UPD\_TO\_PROC SET FORMED BY ROUTER RO, FOR EACH ROUTING PROTOCOL RP\_X THAT RO IS RUNNING, AND EACH OPERATIONAL PORT PO, SEND OUT THE FOLLOWING UPDATE SET TO THE CONNECTION THAT POINTS TO RO, PO: {RT\_EL\_OUT\_L RT\_EL\_OUT = SEND(RT\_EL\_UPD, RP\_X, <RO, PO> WHERE RT\_EL\_UPD BELONGS TO UPD\_TO\_PROC)}

FIG. 43D

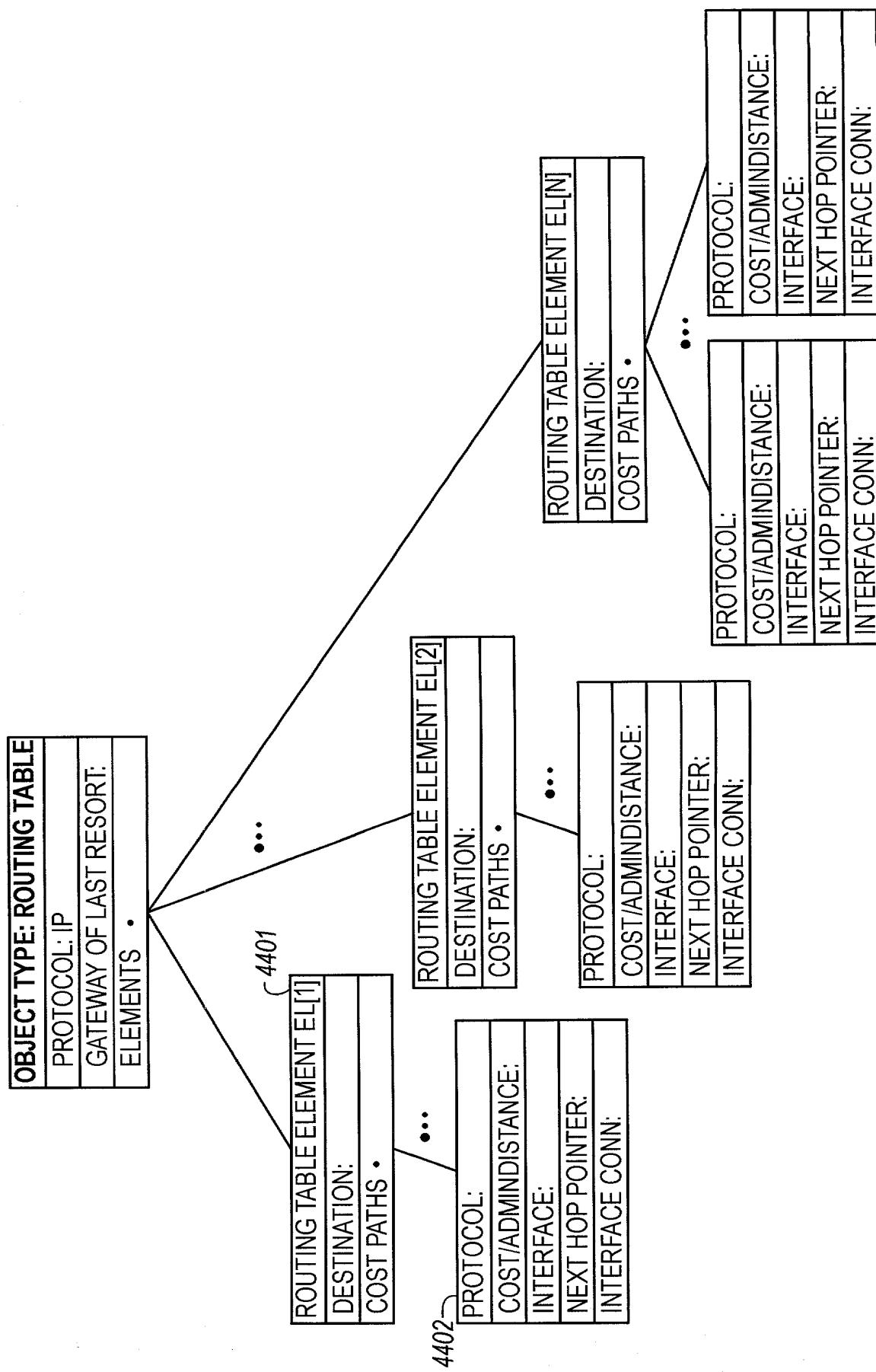
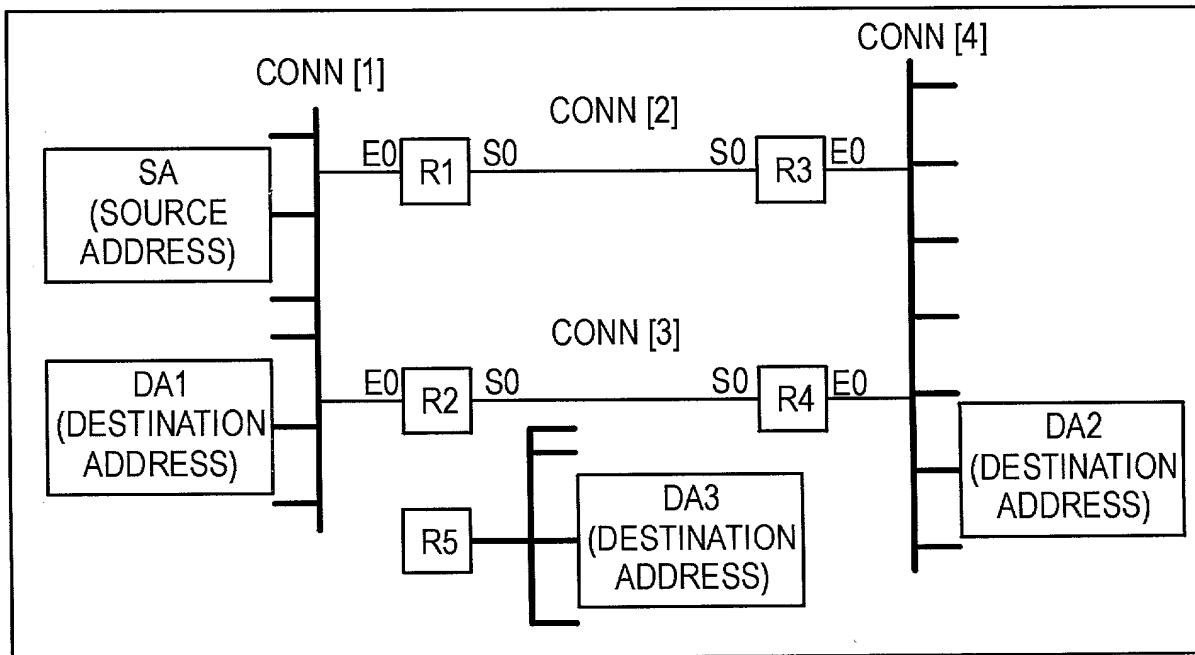


FIG. 44

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DATA LABELS USED IN  
CPS DISCUSSION

**SC** SOURCE CONNECTION  
**DC** DESTINATION CONNECTION  
**SA** SOURCE ADDRESS  
**DA** DESTINATION ADDRESS  
**CPS** COMPLETED PATH SET  
**APS** ACTIVE PATH SET  
**SPT** SINGLE PROTOCOL TOPOLOGY  
**CR** CURRENT ROUTER  
**NC** NEW CONNECTION  
**EL** ROUTING TABLE ELEMENT  
**P** PROTOCOL  
**CPO** COST PATH OBJECT

**DEFINITION: COMPLETED PATH SET - CPS**

THE SET HAVING: NO ELEMENTS; 1 ELEMENT; OR, MORE THAN 1 ELEMENT

NO ELEMENTS MEANS: NO PATH FROM SA TO DA

ONE (1) ELEMENT MEANS: ONE PATH FROM SA TO DA

MORE THAN ONE ELEMENT: MULTIPLE PATHS FROM SA TO DA

THE CPS FOR SA TO DA2 LOOKS LIKE:

{[SA;CONN[1];R1;CONN[2];R3;CONN[4];DA2]}

{[SA;CONN[1];R2;CONN[3];R4;CONN[4];DA2]}

THE CPS FOR SA TO DA1 LOOKS LIKE:

{[SA;CONN[1];DA1]}

THE CPS FOR SA TO DA3 LOOKS LIKE:

{}

**FIG. 45**

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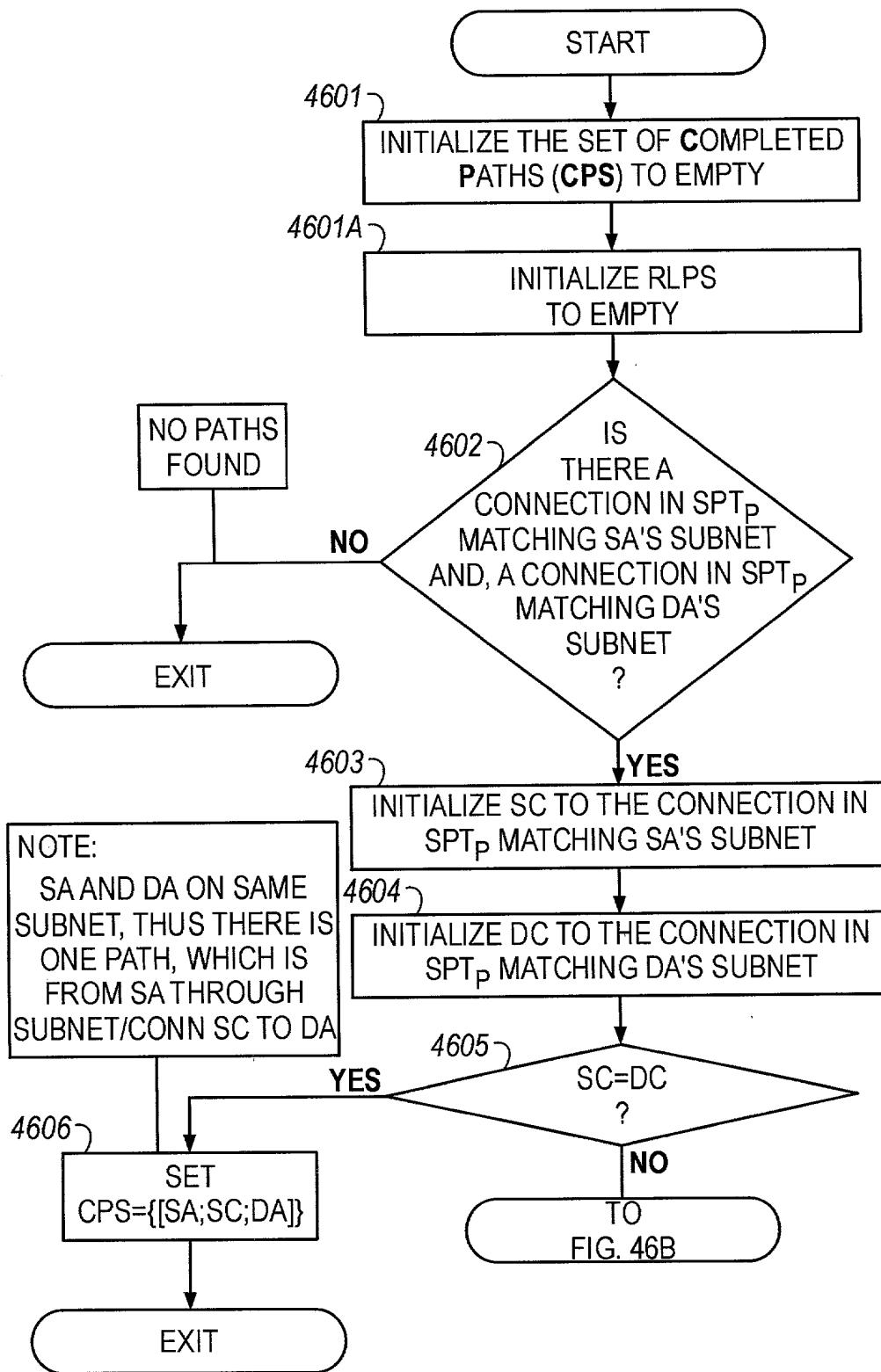
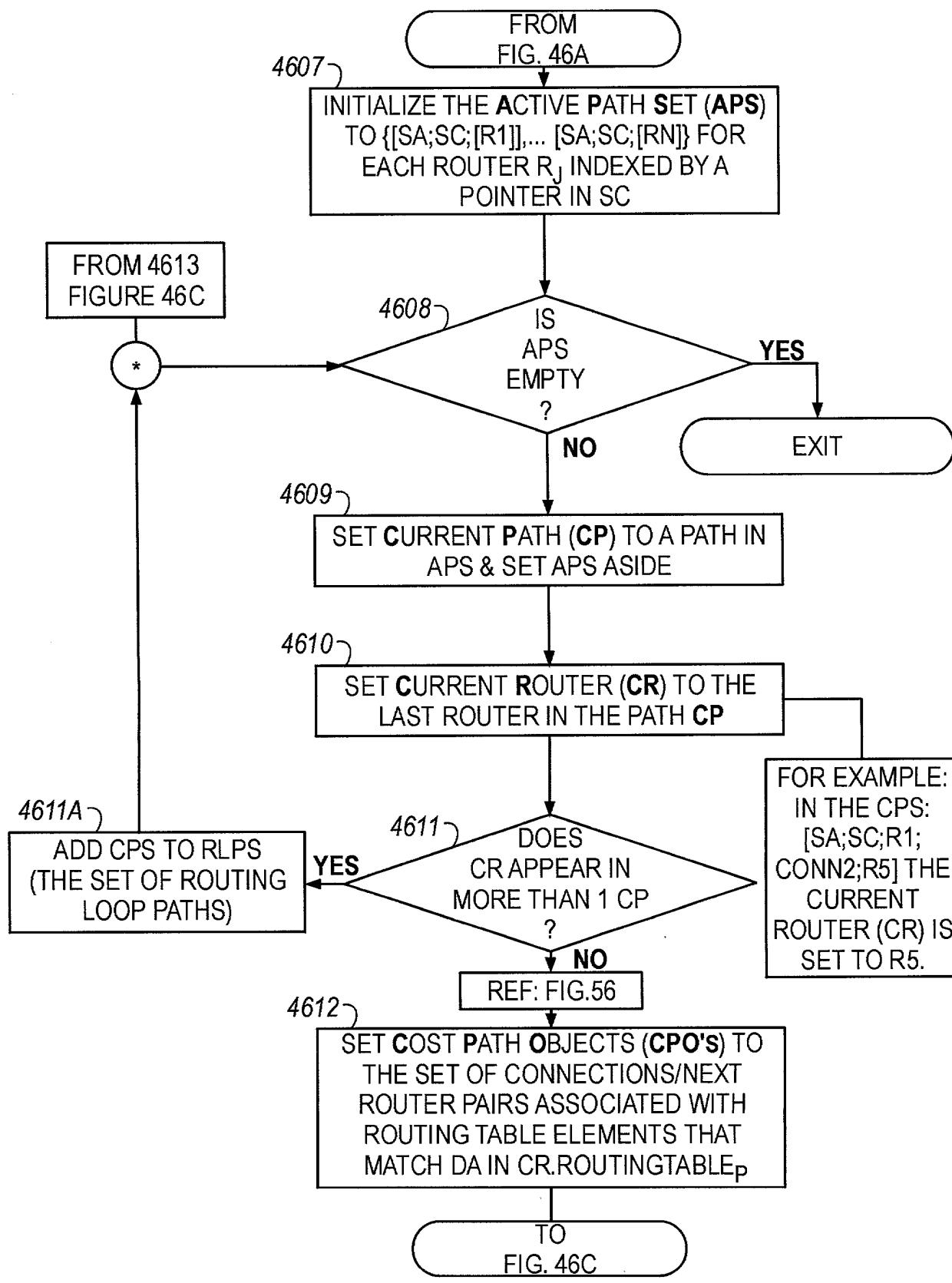


FIG. 46A

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**FIG. 46B**

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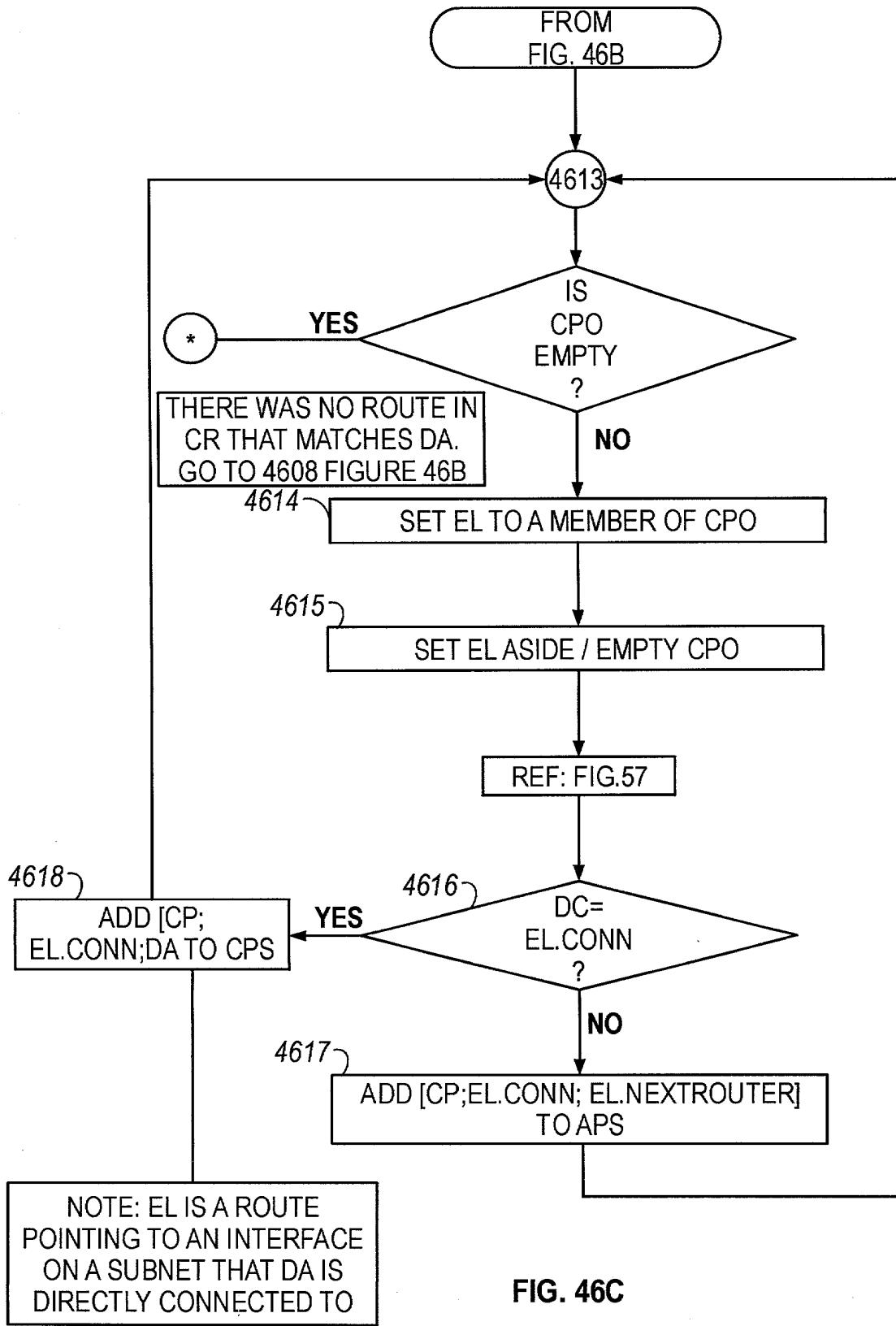


FIG. 46C

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INPUTS: RT - ROUTING TABLE & DA - DESTINATION ADDRESS  
OUTPUTS: CPO - SET OF COST PATH OBJECTS ON MATCHING ELEMENT  
(EMPTY IF NO-MATCH)

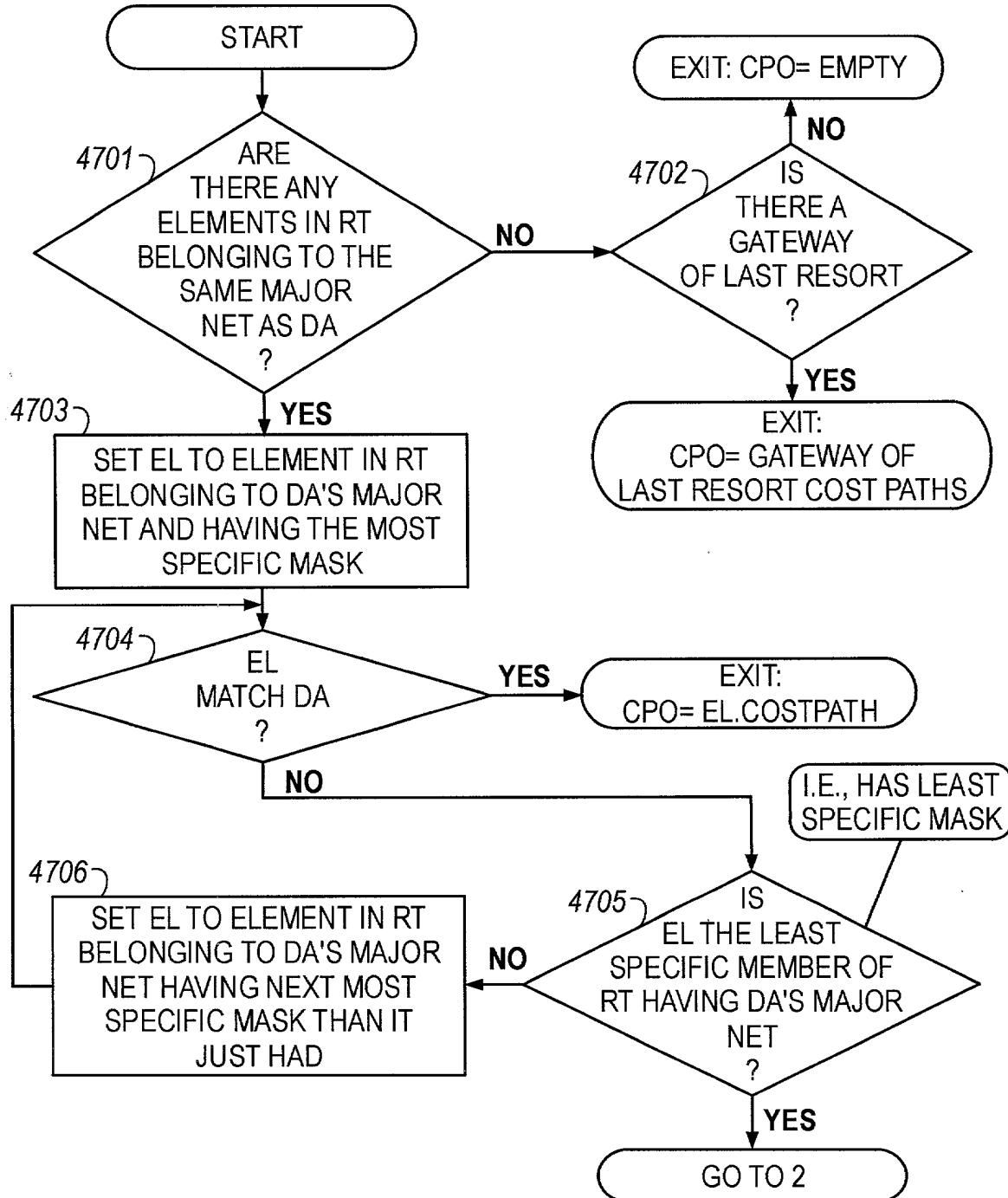


FIG. 47

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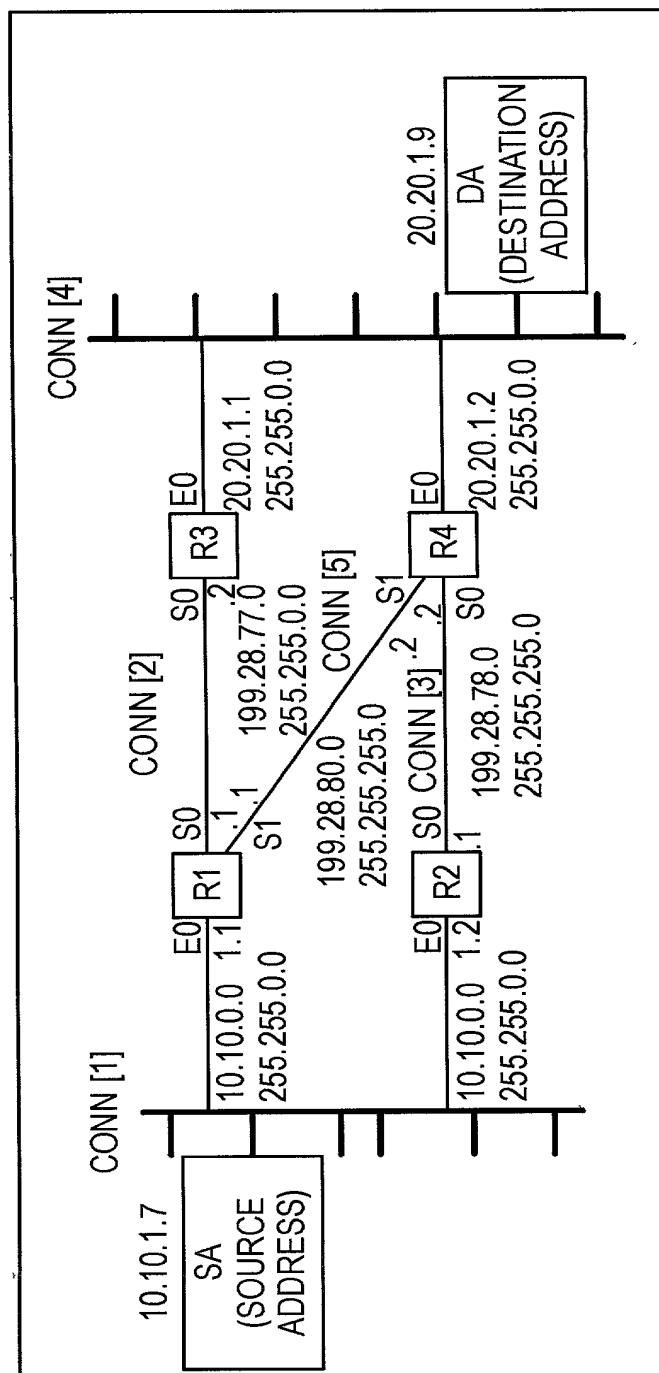


FIG. 48

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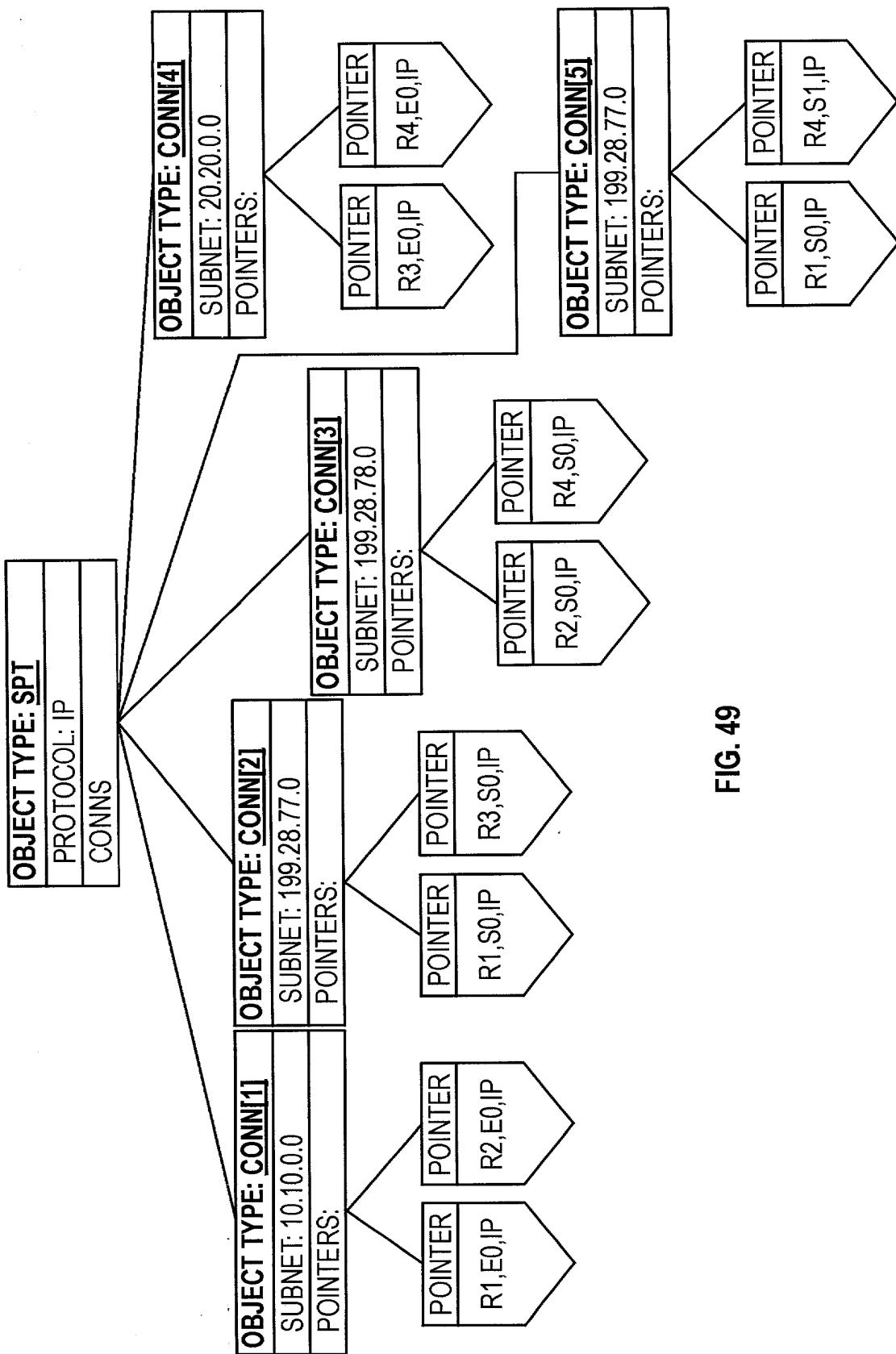


FIG. 49

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ROUTER (R1) / 50325-0630

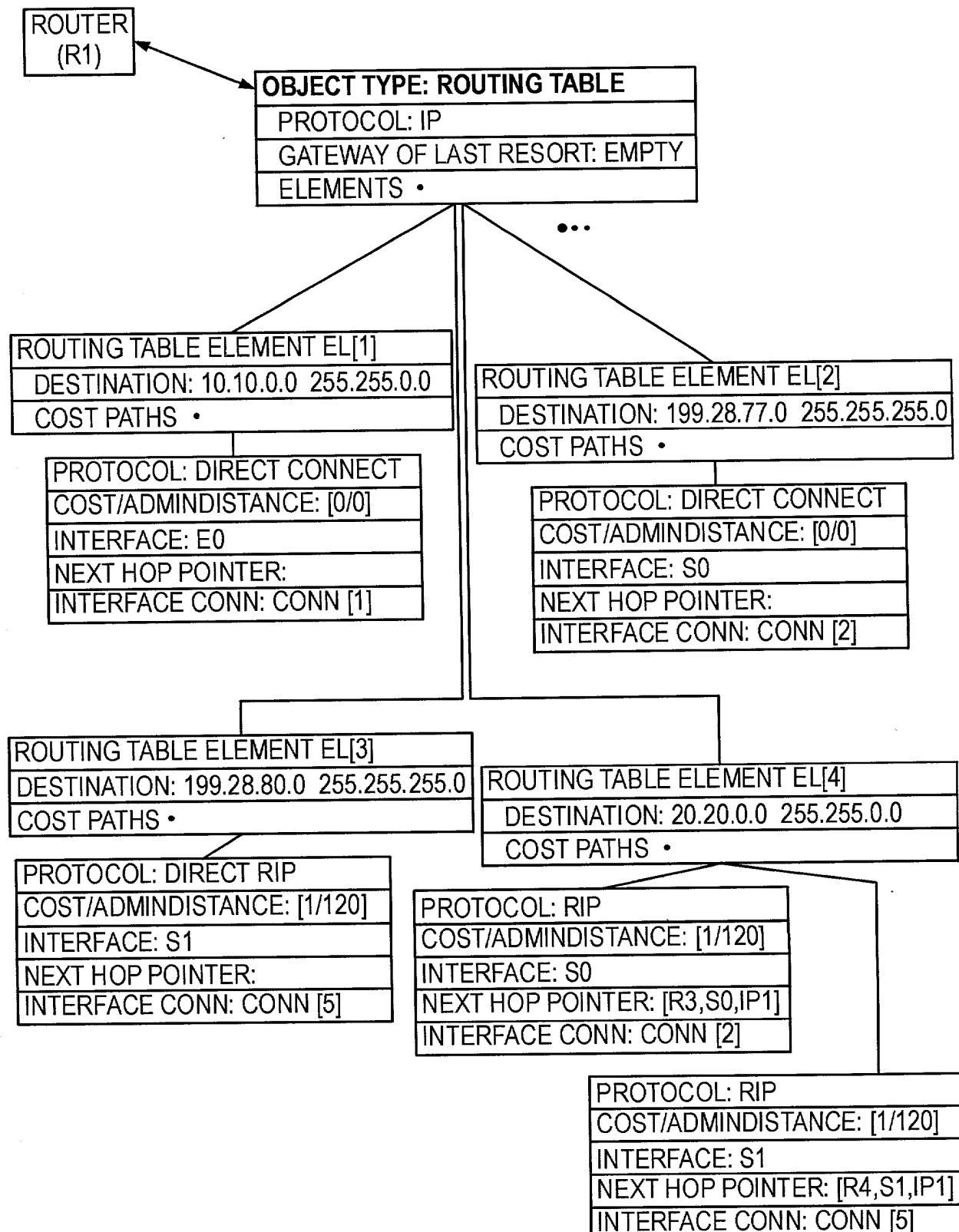


FIG. 50

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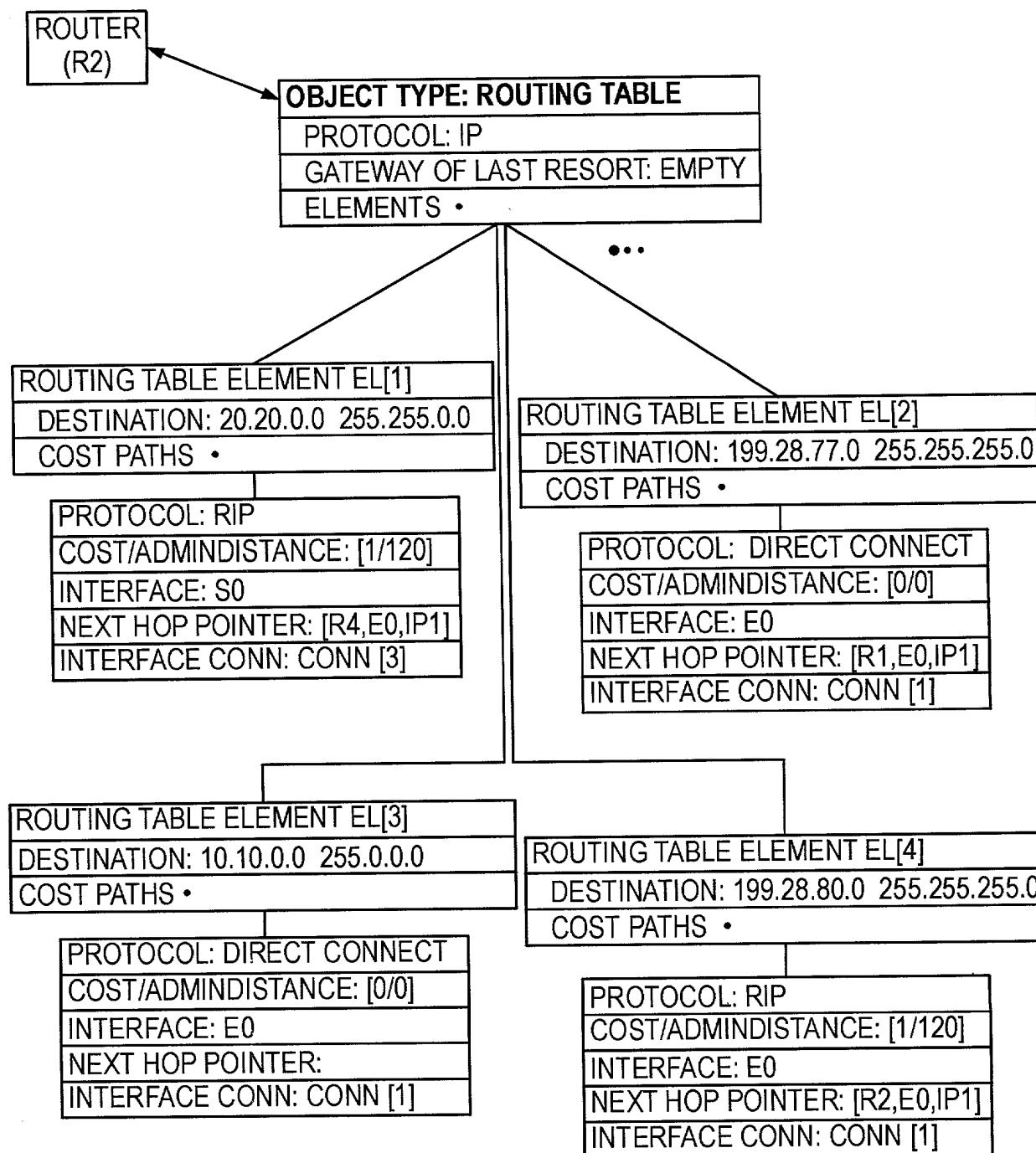


FIG. 51

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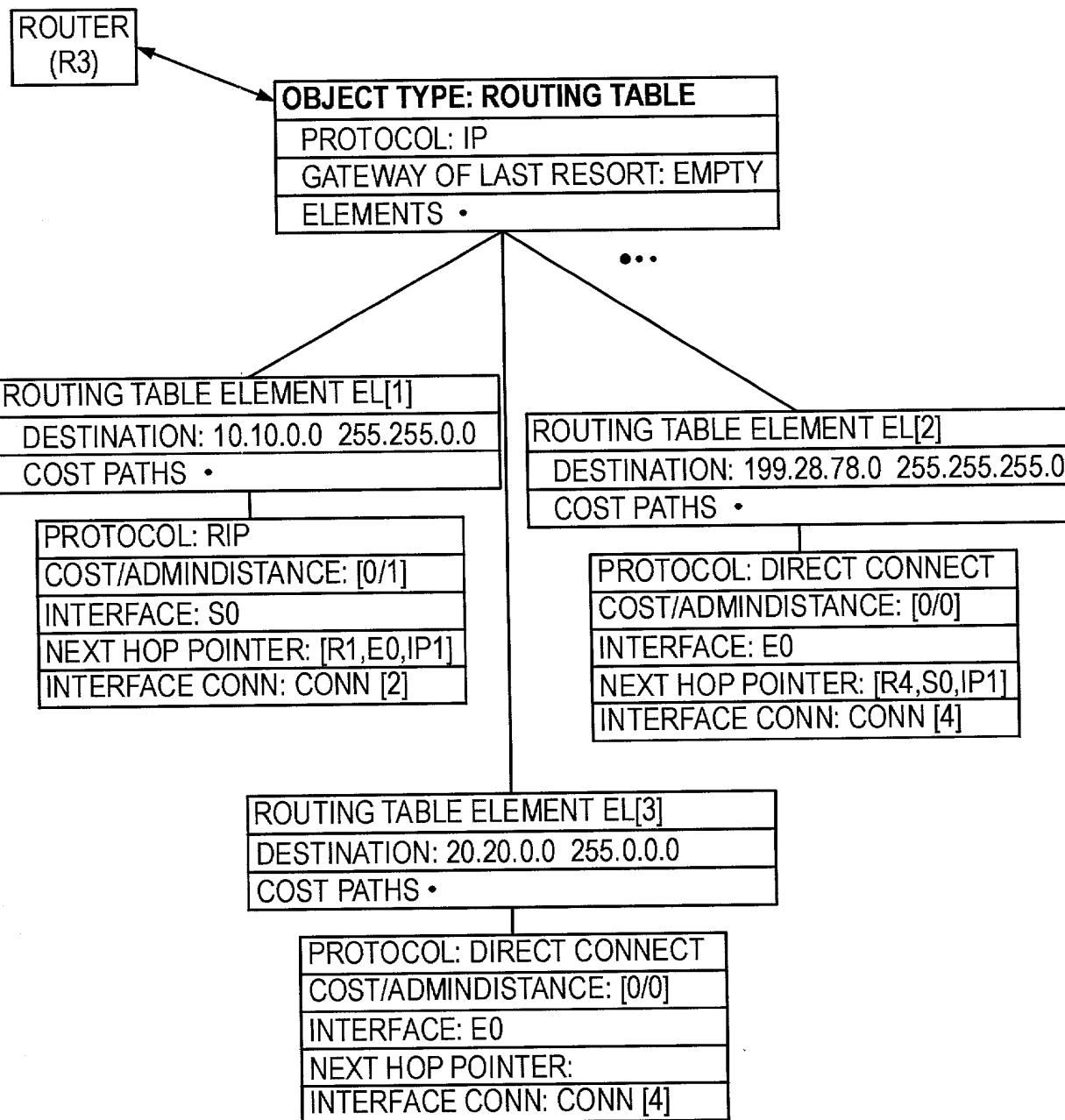


FIG. 52A

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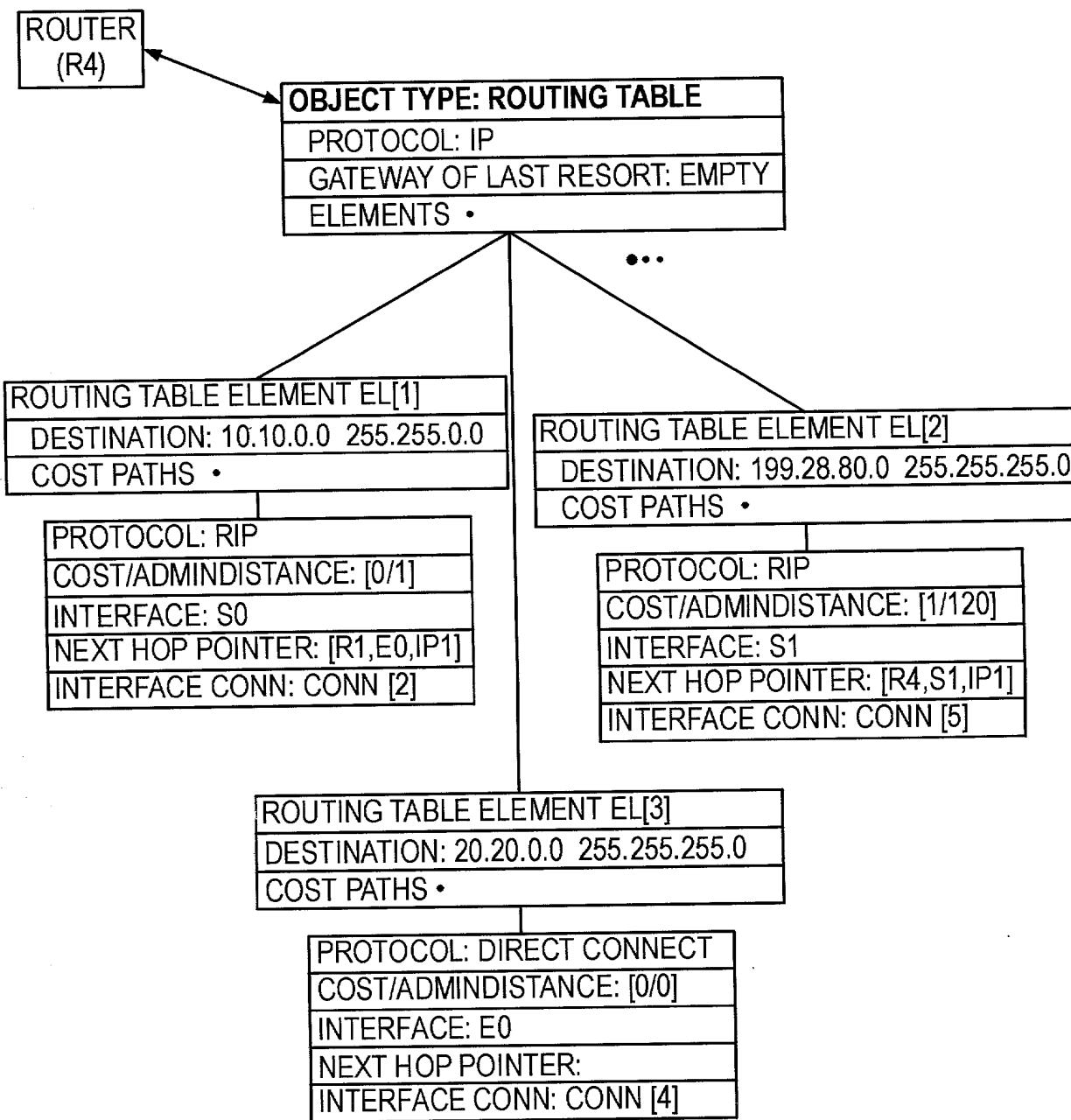


FIG. 52B

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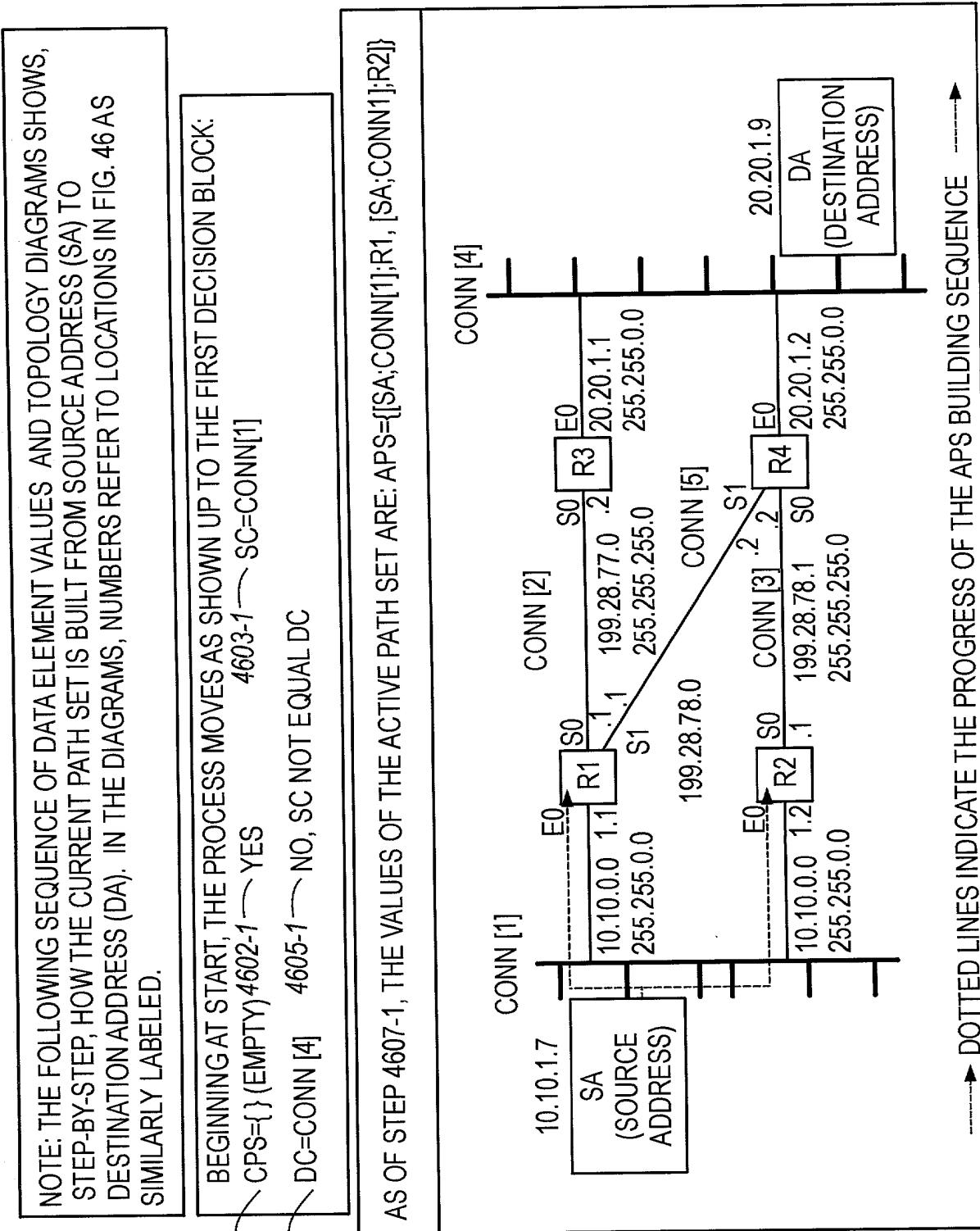


FIG. 53A

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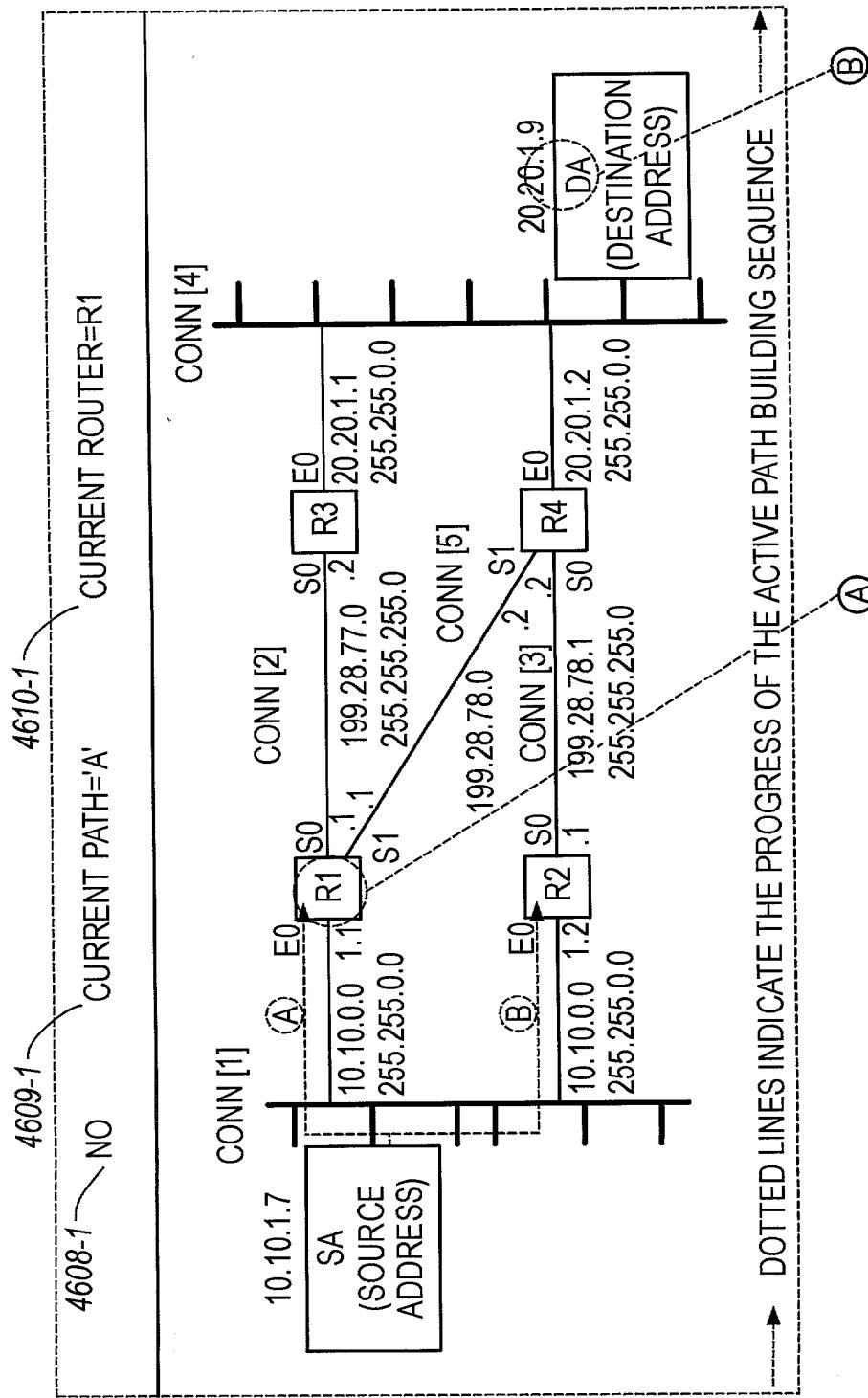


FIG. 53B

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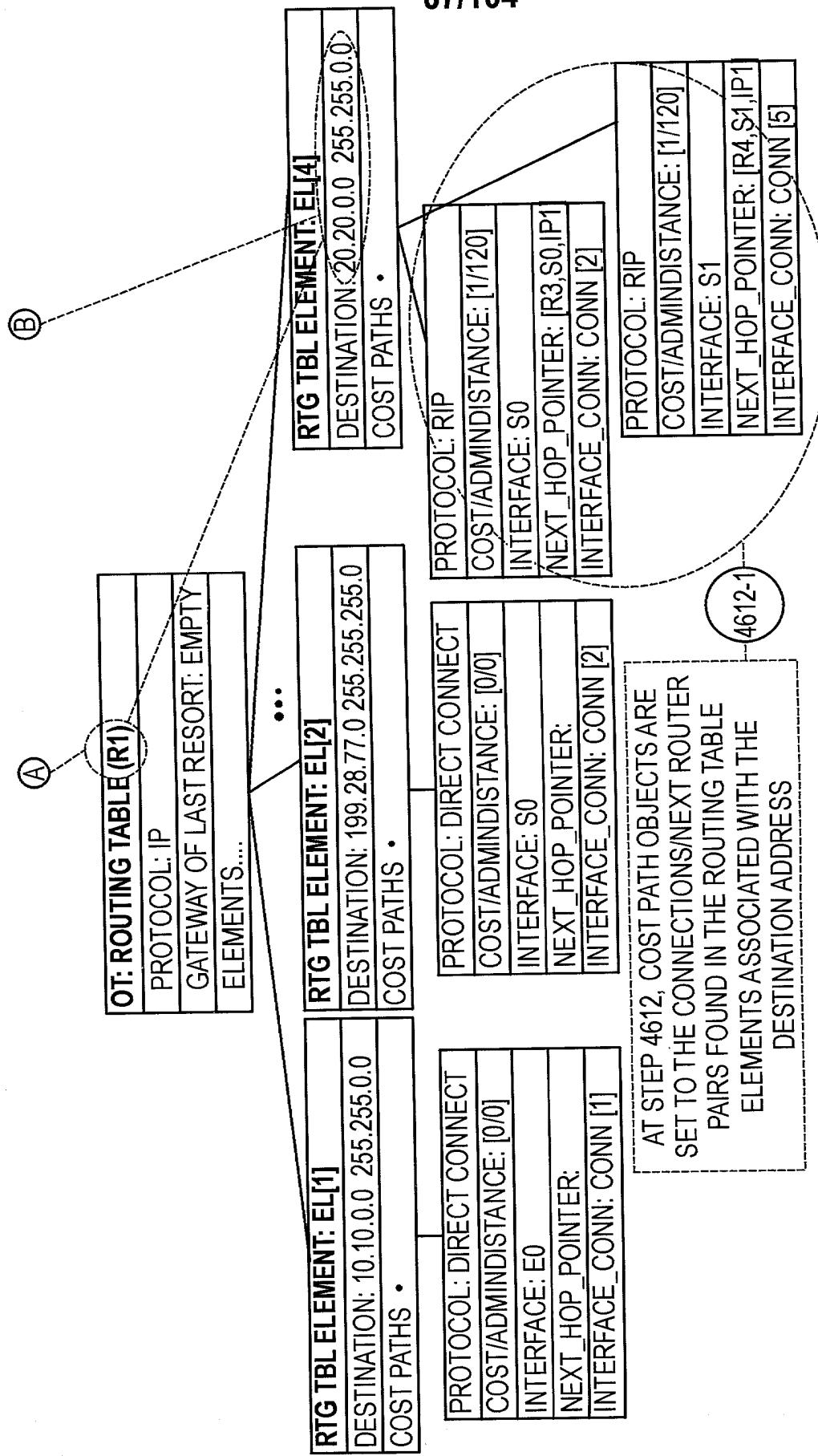


FIG. 53C

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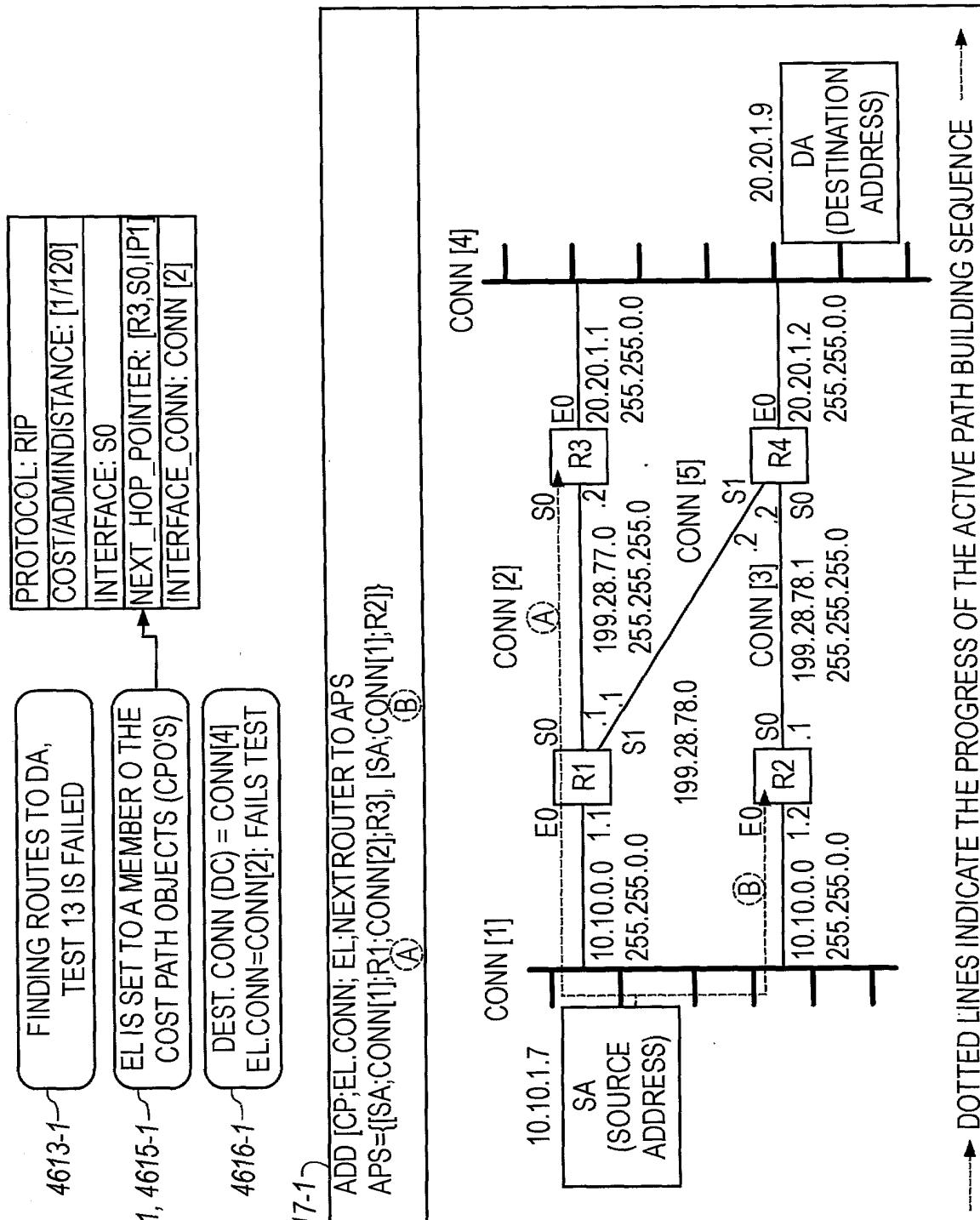
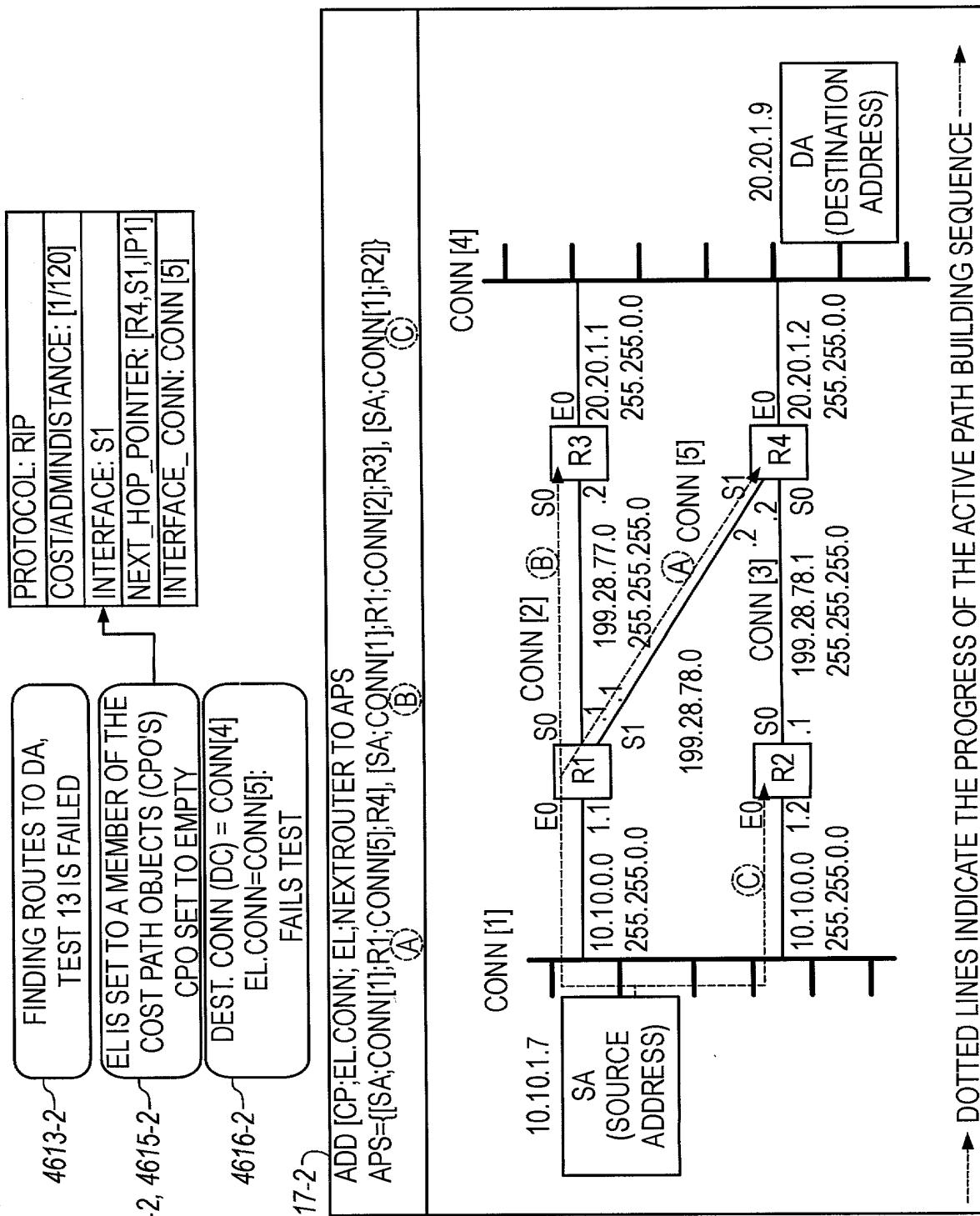


FIG. 53D

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AFTER STEP 4617,  
THE FLOW  
BRANCHES BACK  
UP TO STEP 4613...

FIG. 53E

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4613-3

CPO IS EMPTY,  
GO TO STEP 5308

4608-2

APS IS NOT EMPTY

4609-2, 4610-2

CP = [SA;CONN[1];  
R1;CONN[5](R4)]

CR = R4

AT STEP 4612, COST PATH OBJECTS ARE SET TO THE CONNECTIONS/NEXT  
ROUTER PAIRS FOUND IN THE ROUTING TABLE ELEMENTS ASSOCIATED  
WITH THE DESTINATION ADDRESS

4614-3, 4615-3

EL IS SET TO A MEMBER  
OF THE COST PATH  
OBJECTS (CPO'S)  
CPO SET TO EMPTY

PROTOCOL: DIRECT CONNECT  
COST/ADMINDISTANCE: [0/0]  
INTERFACE: E0  
NEXT\_HOP\_POINTER:  
INTERFACE\_CONN: CONN [4]

CR =  
ROUTER  
R4

4616-3

DEST. CONN (DC) = CONN[4]  
EL.CONN = CONN [4]:  
YES CONDITION

4618-1

ADD  
[SA;CONN[1];R1;CONN[5];R4;CONN[4];DA]  
TO CPS (WHERE CP =[SA;CONN[1];R1;CONN[5];R4])

FIG. 53F

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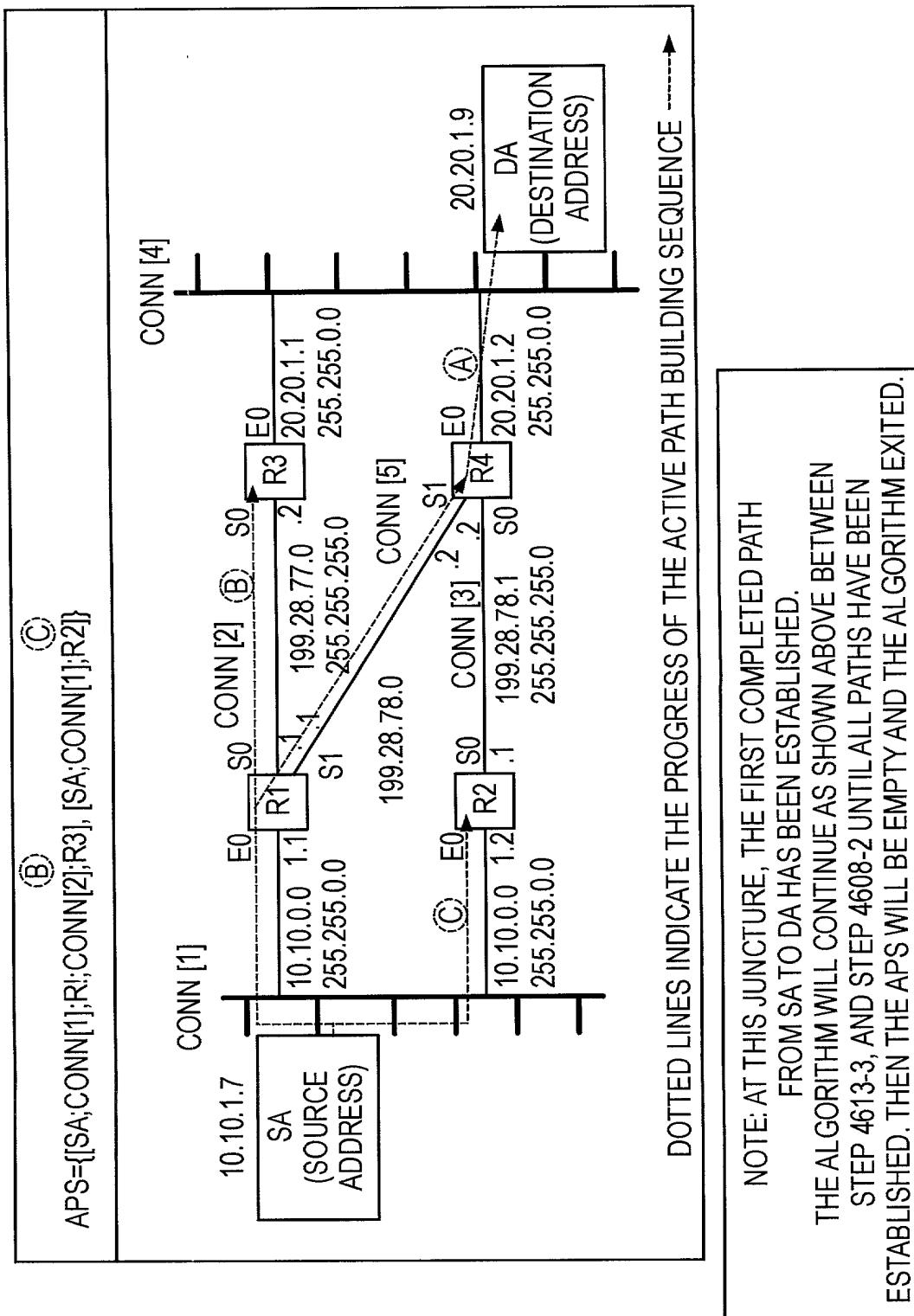
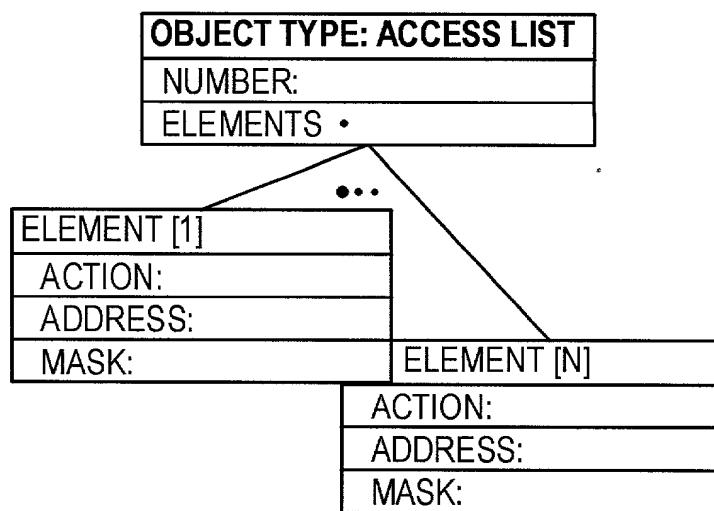


FIG. 53G

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**FIG. 54**

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INPUTS:  
ADDRESS (ADDR BEING CHECKED)  
& ACCL (ACCESS LIST BEING MATCHED  
AGAINST)

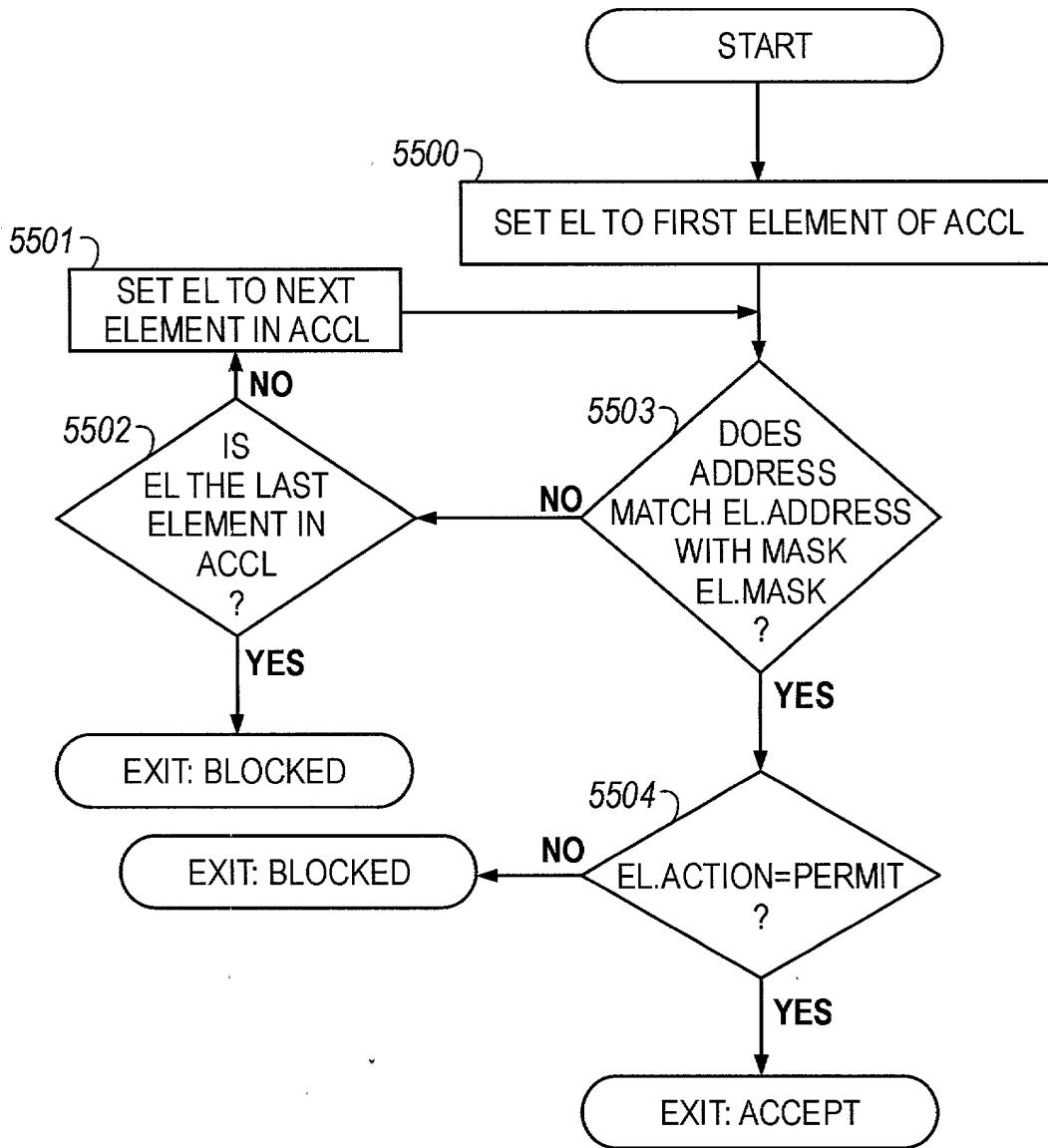


FIG. 55

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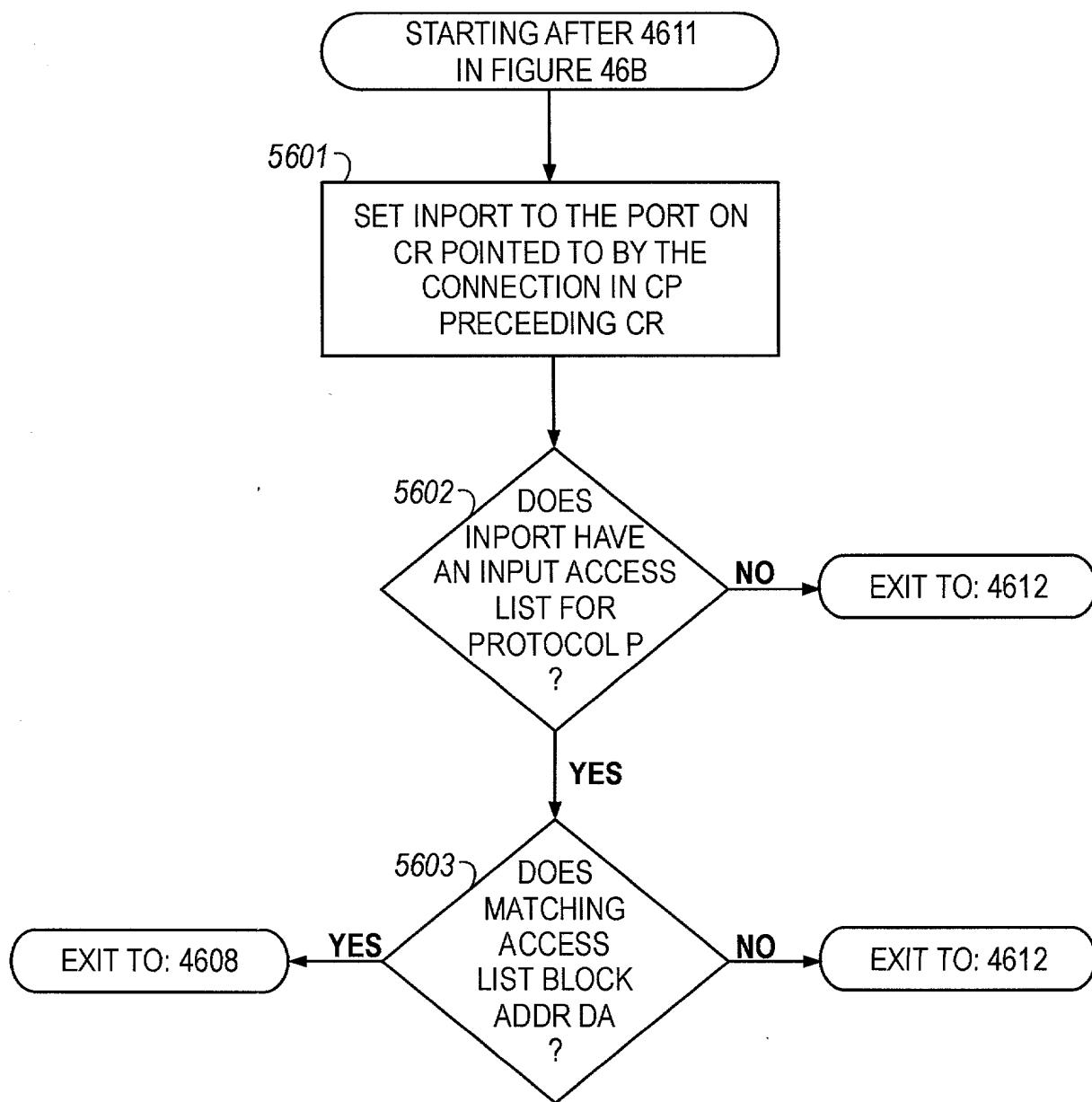


FIG. 56

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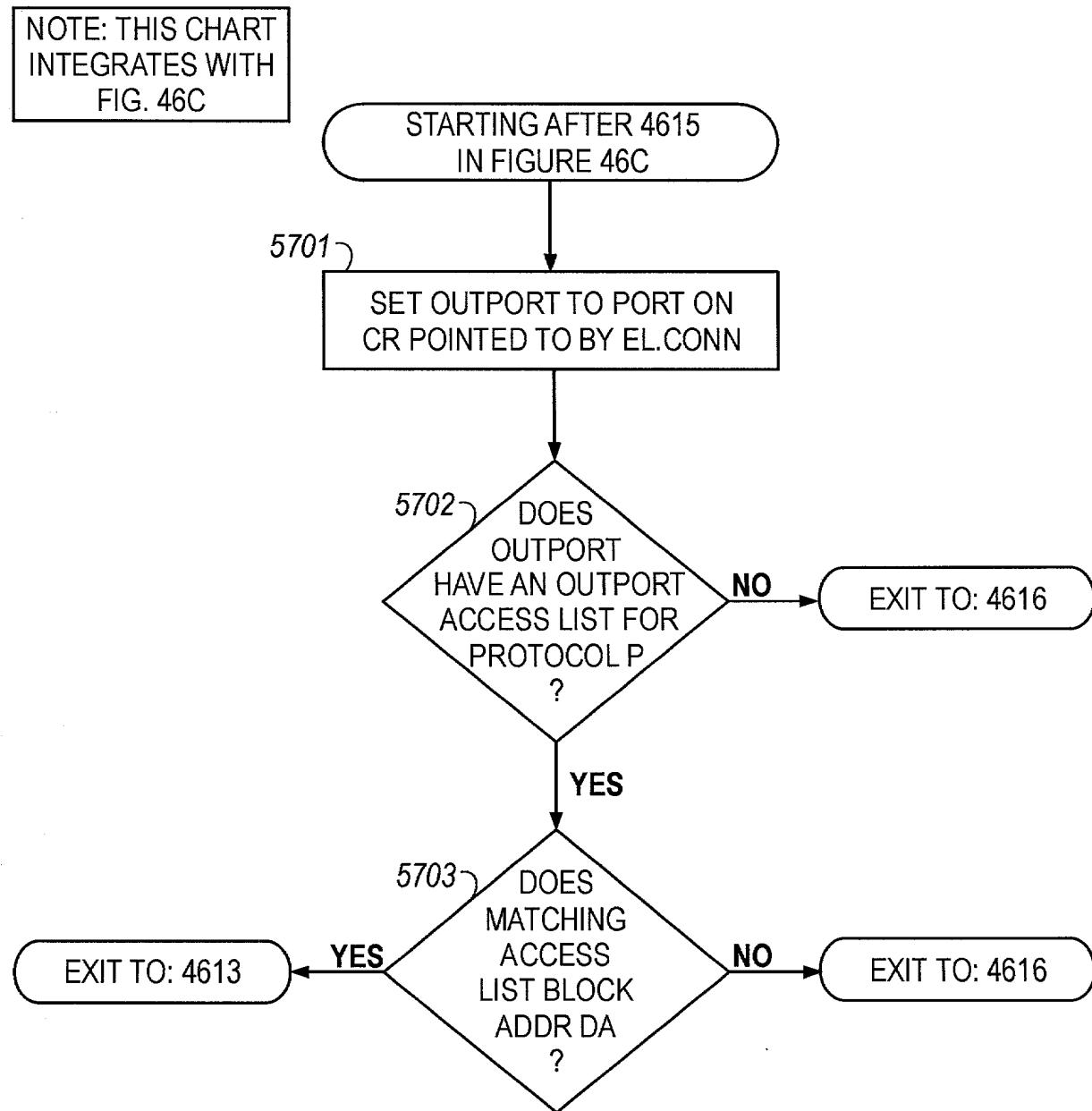
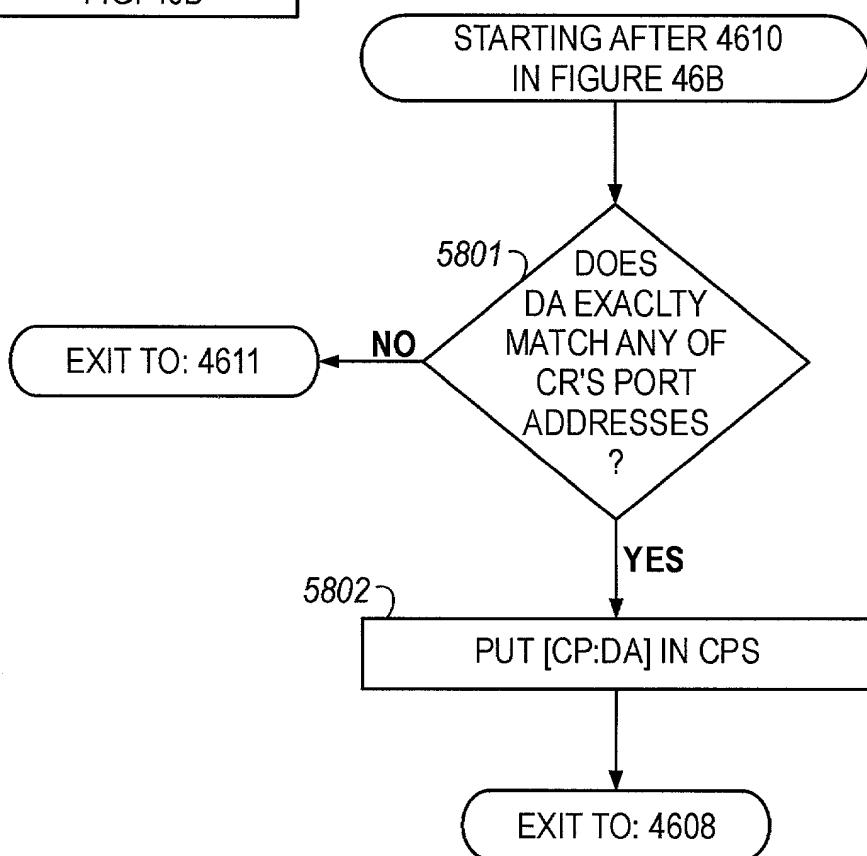


FIG. 57

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NOTE: THIS CHART  
INTEGRATES WITH  
FIG. 46B



**FIG. 58**

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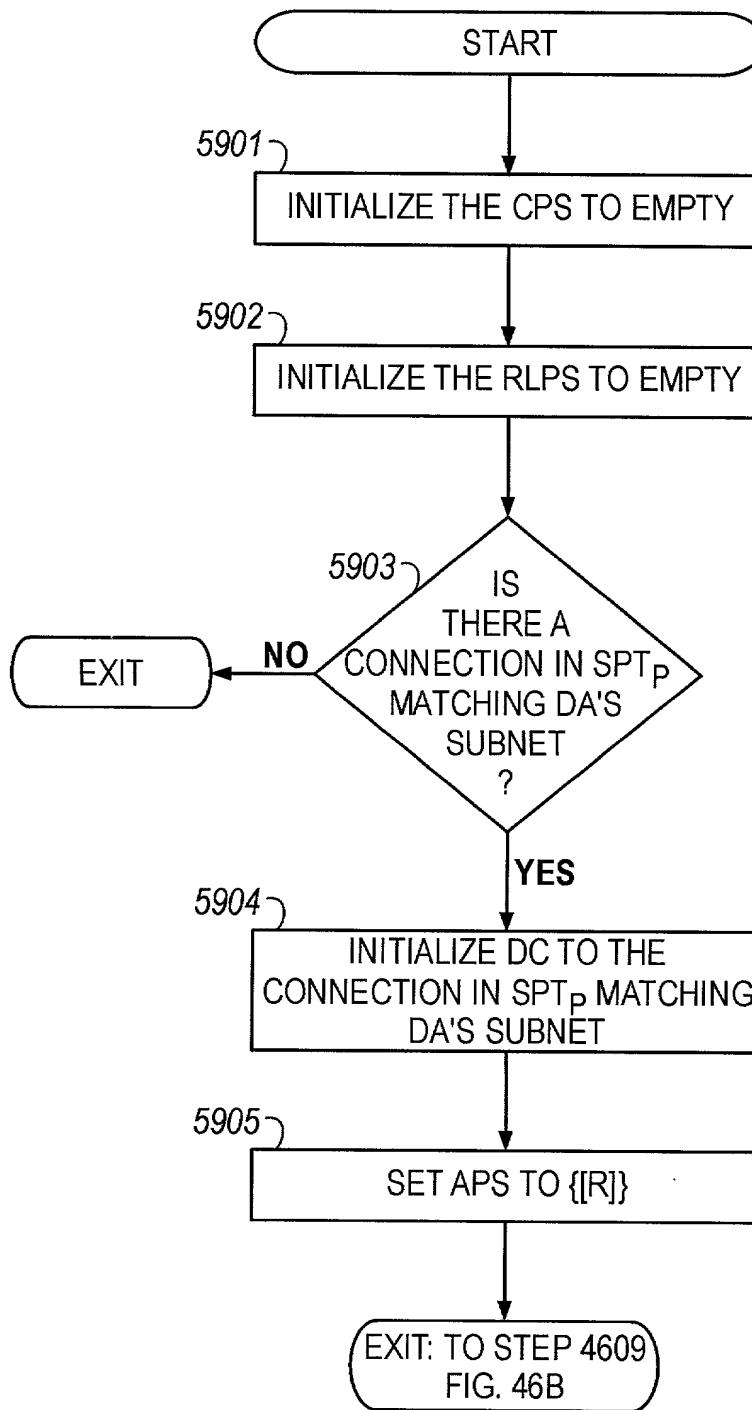


FIG. 59

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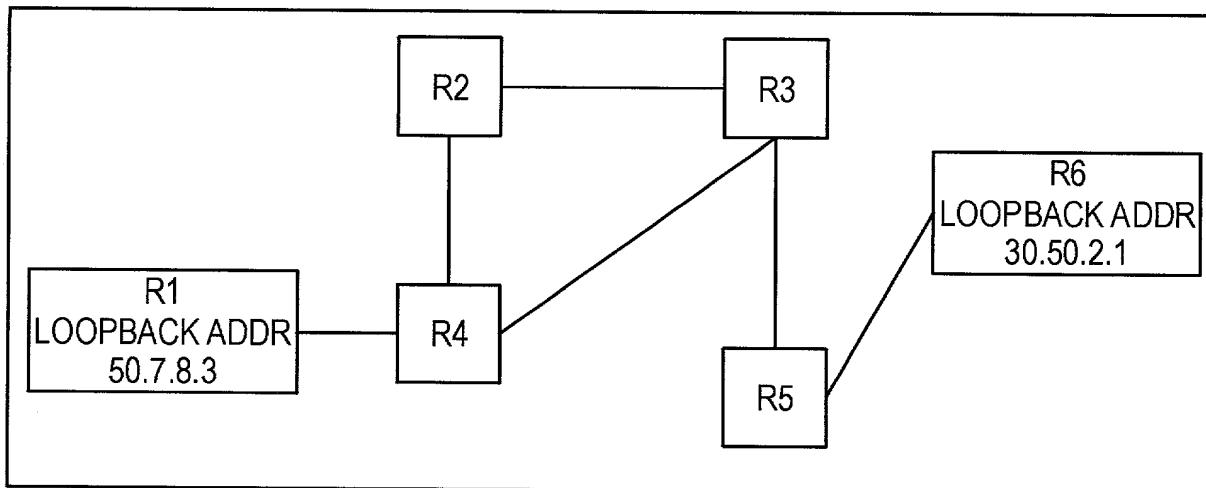


FIG. 60

**ROUTER R1:**

```
VERSION 10.0
!
HOSTNAME ROUTER1
!
SOURCE-BRIDGE RING-GROUP 7
SOURCE-BRIDGE 7 TCP 30.50.2.1
!
INTERFACE LOOPBACK 1
IP ADDRESS 50.7.8.3 255.255.0.0
!
END
```

**ROUTER R6:**

```
VERSION 10.0
!
HOSTNAME ROUTER6
!
SOURCE-BRIDGE RING-GROUP 7
SOURCE-BRIDGE 7 TCP 50.7.8.3
!
INTERFACE LOOPBACK 0
IP ADDRESS 30.50.2.1 255.255.0.0
!
END
```

FIG. 61A

FIG. 61B

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20210803120000

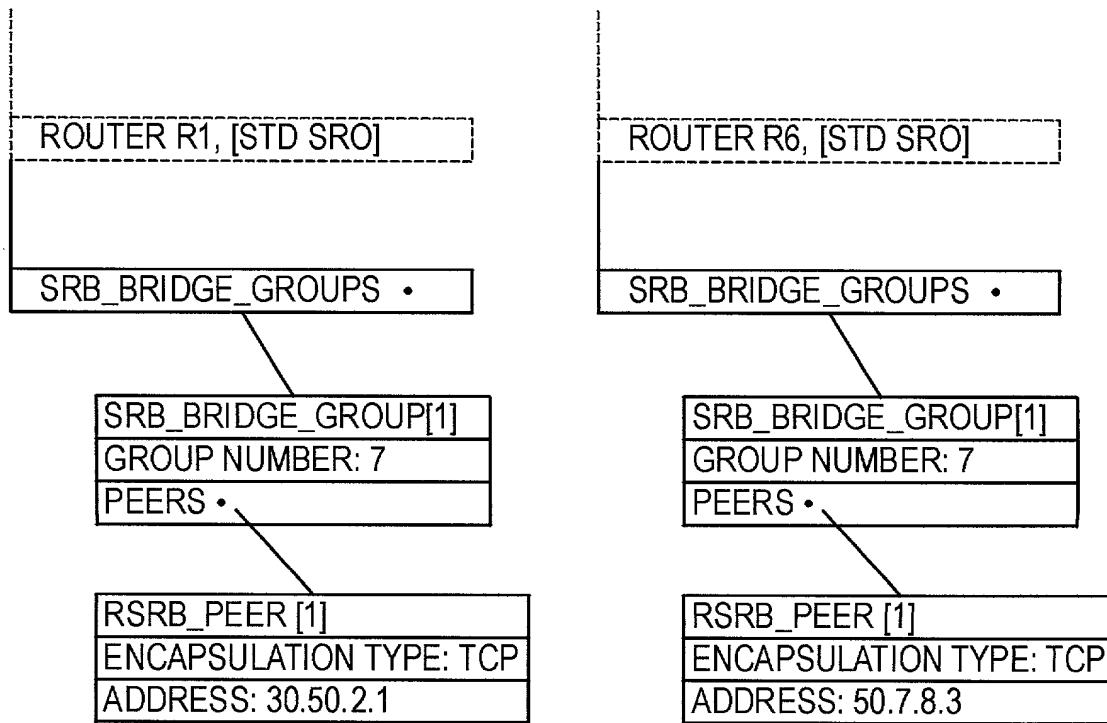


FIG. 62

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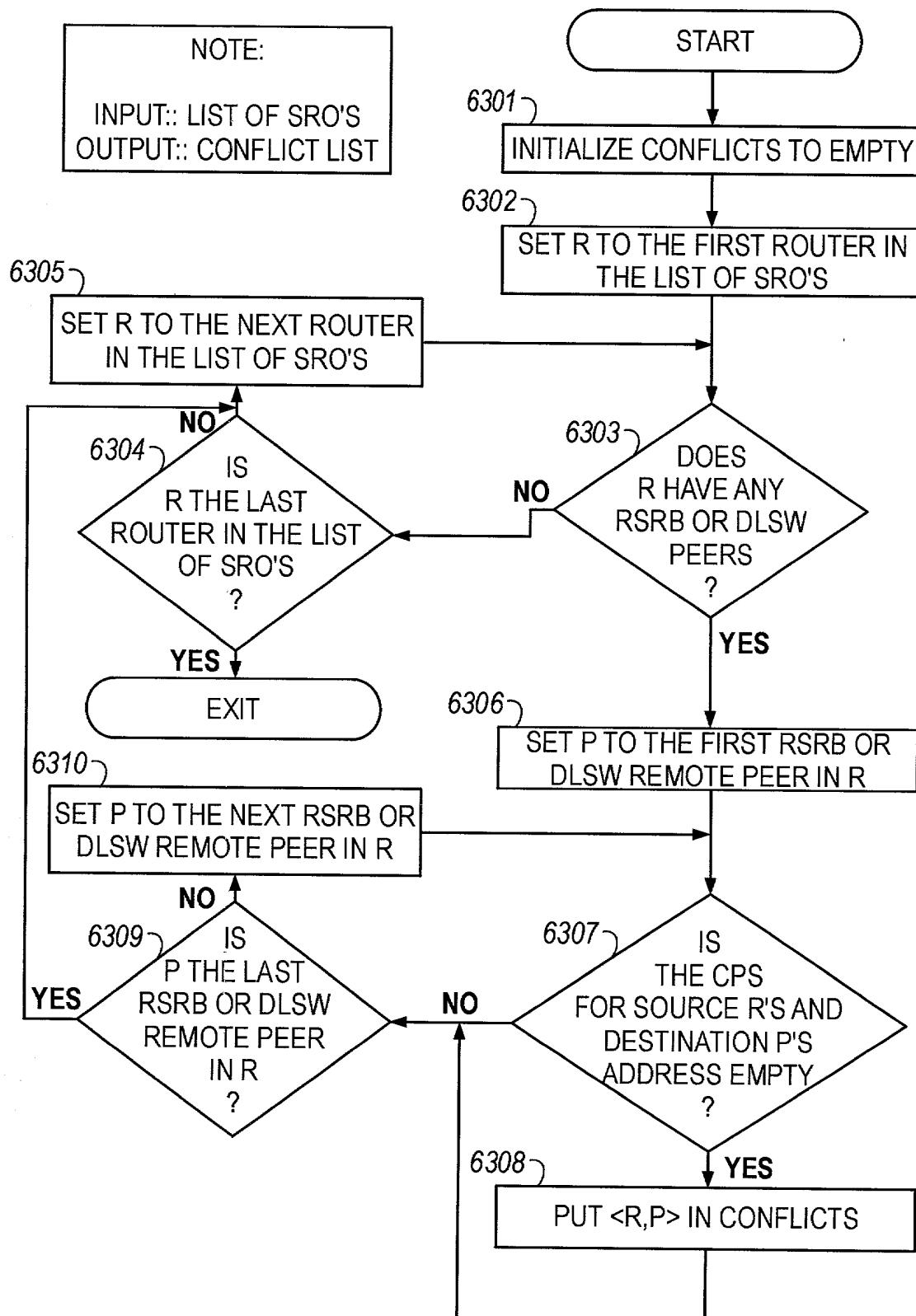


FIG. 63

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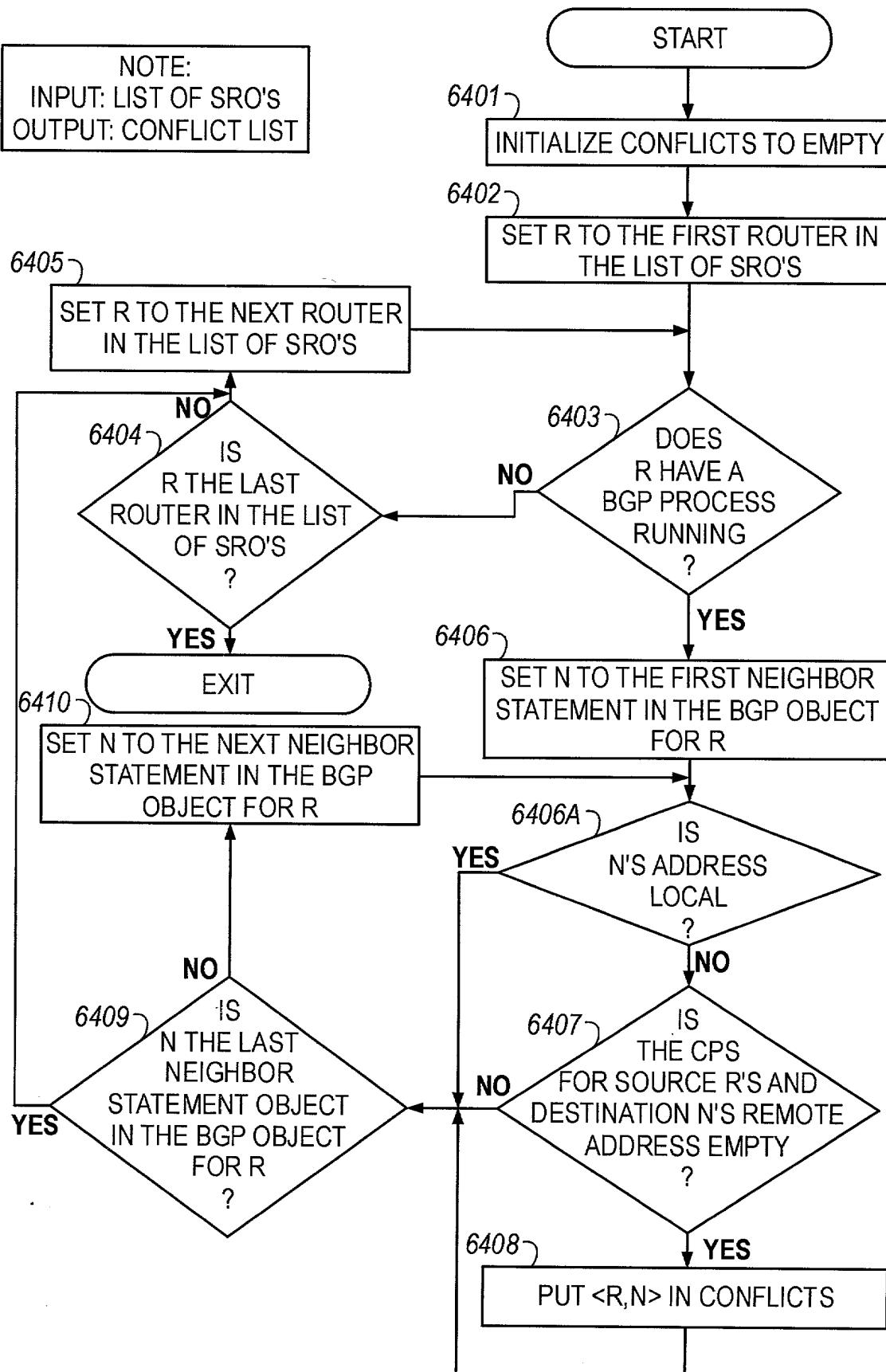


FIG. 64

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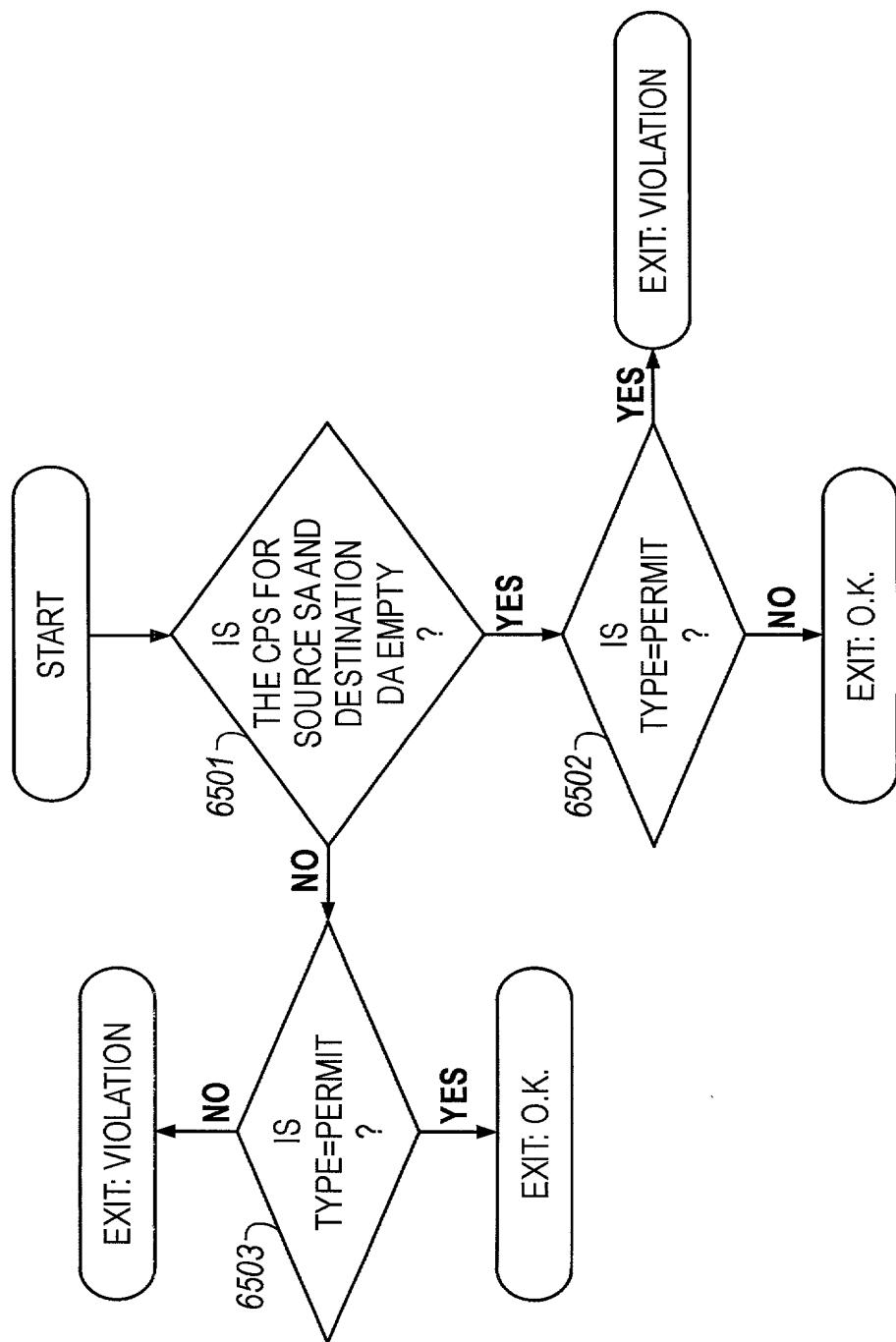


FIG. 65

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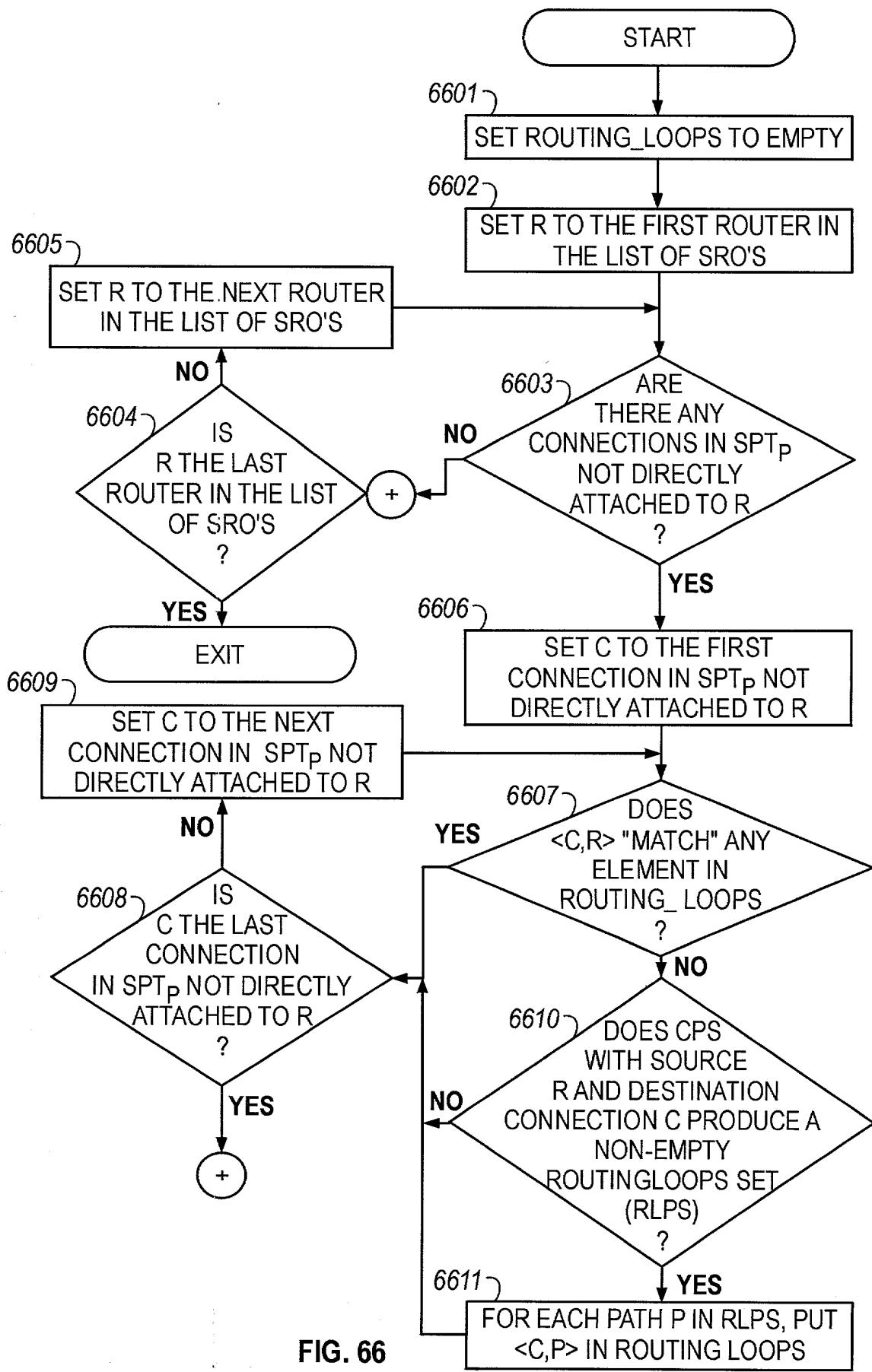


FIG. 66

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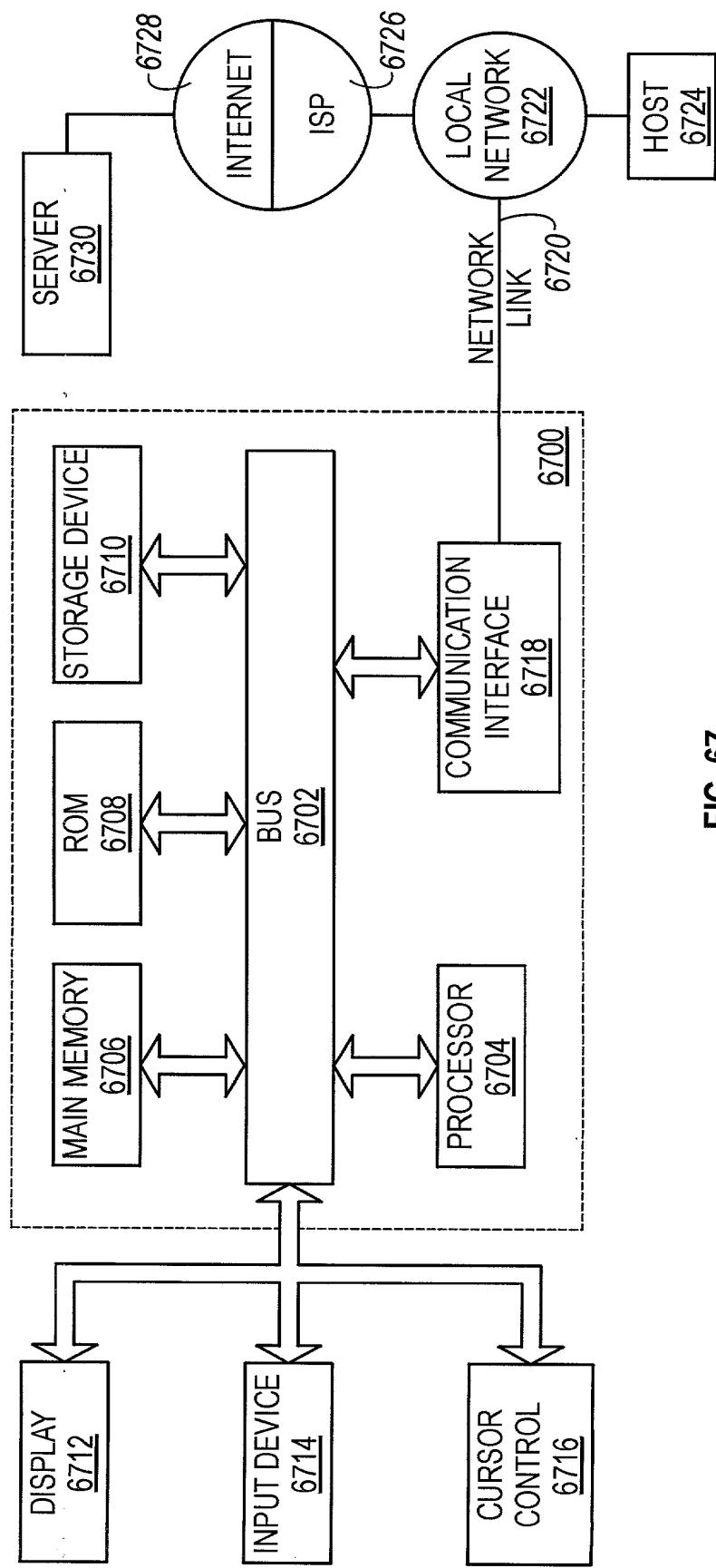


FIG. 67